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PRINCIPLES OF SURGICAL PRACTICE

THE PATHOLOGICAL CONSIDERATIONS RELATING TO THE EARLY DIAGNOSIS AND CURATIVE SURGICAL TREATMENT OF CARCINOMA OF THE ESOPHAGUS

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THE recent revival of interest in the surgical treatment of esophageal carcinoma is both timely and deserving. Its importance is more fully appreciated in view of the fact that it is fourth in frequency of all malignant tumors occurring in men over twenty years of age. In a survey compiling 124,827 autopsies from 42 German pathological institutions between 1925 and 1933, Dormanns found it was surpassed in frequency only by cancer of the stomach, lung, and rectum. Of 23,139 deaths due to malignancy in patients more than twenty years of age, 8 per cent were due to this tumor.

Until recent years, the mortality of this condition was practically 100 per cent. Surgical and x-ray treatment alike had met with almost complete failure, Torek's successful resection being the only case in which the patient survived for more than five years. Experimental investigation had suggested methods of surgical attack but successful clinical application was long delayed. In this respect, lack of early correct diagnosis played a major rôle. However, the rapid development of thoracic surgery has been very important in the recent successful surgical treatment and the revival of general interest in this disease. That this interest is increasing is demonstrated by reports of continued success in its surgical management. This should be encouraged, for only in this way can real progress be effected.

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The reasons for this lesion resisting successful treatment until recent years are threefold:

1. The lack of early correct diagnosis.
2. The poor results from x-ray therapy.
3. The high mortality of operative treatment.

The first two of these are influenced fundamentally by the pathological characteristics of the tumor, the third primarily by the delayed development of intrathoracic surgery.

THE INFLUENCE OF PATHOLOGICAL ANATOMY AND PHYSIOLOGY ON THE CLINICAL COURSE

The symptoms of this malady are brought about by:

1. Mechanical obstruction of the passageway by the tumor.
2. Influence of the tumor on the adjacent structures.
3. Metastatic lesions.

Although not typical for this condition, dysphagia is the most outstanding symptom in the majority of cases. The location of the tumor makes little difference in this respect except in the interval between the act of swallowing and the experiencing of a sense of obstruction. By far the majority of the tumors are located in the middle and lower segments of the organ, only 10 per cent occurring in the upper part.

CLASSIFICATION OF TUMORS

The gross appearance of these tumors varies somewhat, and three principal forms are recog-

nized, viz.: scirrhous, medullary, and papillary. These gross characteristics influence to some degree the symptoms produced by the tumor. This classification bears no relation to the histological nature of the tumor, the majority (95 per cent) of which are of the squamous-cell variety. All other cell types (adenocarcinoma, basal-cell carcinoma) are usually located in the lower portion of the esophagus.

Scirrhous carcinoma. Early in its course, this type consists of a thickening of the wall of the esophagus which forms a nodule or tubercle. Extension early is in the circumferential direction, later in the longitudinal direction. Through its circular growth there results a narrowing of the lumen to a marked degree, the length of which is determined by its longitudinal extension. The segment of the organ involved may be quite short unless measures are taken to relieve the obstructive symptoms caused by the extreme degree of stenosis of the lumen.

The mucosa overlying the scirrhous type may remain relatively little involved for weeks or months. Thus on esophagoscopy no ulcerating surface is visible and a biopsy of superficial tissue is apt to show no evidence of tumor. This must be kept in mind in the differential diagnosis of stenosing lesions of this organ. Later, the characteristics of a malignant tumor appear, with the development of irregular borders and a crater-like destruction in the central portion.

Medullary carcinoma. This type usually becomes much larger than the scirrhous, since it ulcerates much earlier and because of this does not lead to as high a grade of stenosis. The whitish, often friable decomposing tumor develops a very irregular mucous membrane surface and may present a cauliflower-like appearance. This type may become as large as the palm of the hand.

Papillary carcinoma. In this form marked cauliflower-like development is seen usually with a foul central necrosis. Less often, pedunculated growths are present and are attached by a broad base.

INFLUENCE ON ADJACENT STRUCTURES

Because of its close proximity to other important structures, complications caused by direct extension of the tumor are common (about 50 per cent). The first symptoms noted may be from this source, a fact which partially accounts for the variability of the clinical course.

Tumors located near the lower end of the esophagus may invade the wall of the stomach and be confused with carcinoma of that organ. Perforations of the respiratory tract by the lesion with resultant infection is of common occurrence. This perforation may involve the trachea near its bifurcation, the primary bronchi, or the parenchyma of the lung. The order of frequency of involvement by direct extension found at autopsy is about as follows: lung parenchyma, 13 per cent; trachea, 5.5 per cent; primary bronchi (usually left), 4.5 per cent; pleura, 3.3 per cent; mediastinum, pericardium, blood vessels, and nerves. Erosion of the wall of the aorta or its branches with sudden exodus by hemorrhage may occur. Involvement of the recurrent laryngeal nerve, especially the left, and of the sympathetic nerves produces symptoms and findings of disturbed functions of these structures.

METASTASES

In addition to the direct influence of the tumor on the wall of the esophagus and neighboring structures, metastases by way of the lymph and blood stream are of primary importance. Extension of the tumor in this manner is quite variable, since Dormanns in the statistics already referred to (1,679 cases of carcinoma of the esophagus) reported the absence of distant metastases in 40 per cent of the cases. (This is explained by the slow advancement of the tumor by direct extension, and by the inhibiting action of regional lymph nodes.) Spread by way of the lymphatics is most frequent, the lymph flow of the upper two thirds of the organ being toward the mediastinal, bronchial, and supraclavicular lymph glands, while that of the lower esophagus is directed toward the cardiac glands along the lesser curvature of the stomach. Distant metastases most frequently involve the lung and pleura (31 per cent) and liver (16 per cent) and to a much lesser extent the kidney, stomach, pancreas, thyroid, peritoneum, and mesentery. Metastases have been reported in almost every organ or structure of the body. Very commonly these secondary growths remain silent, and undoubtedly are overlooked or are not readily demonstrable at operation or autopsy. In spite of the lack of symptoms directed toward these distant secondary growths, it is very doubtful that carcinoma of the esophagus remains confined to its primary location for a long time before metastases occur. This is particularly the case regarding the regional lymph glands. Huenermann and Eberhardt from their own experience with 182 cases and from recent reports believe that at least 10 per cent of the patients already have metastases when first observed. In their cases this belief was substantiated by roentgenograms of the lungs or at operation. Of 72 necropsies 47, or 65 per cent, revealed metastatic lesions outside of the regional lymph nodes. This

concurs with Dormann's report of 60 per cent involvement in a much larger series of cases. In these cases, however, the duration of symptoms when the patient is first seen is of great importance. The average duration of life expectancy following the onset of symptoms is between five and eight-tenths and eight and two-tenths months. This is very little influenced by the age of the patient or by the location and type of tumor. Since these statistics on the incidence of distant metastases were gathered from necropsy material, it is not unlikely that the percentage would be much lower during the early course of the disease, a factor of great importance when surgical treatment is considered.

The following cases illustrate many of the features which have been mentioned and emphasize their importance in a consideration of the diagnosis and surgical treatment of this tumor:

CASE 1. H. H., a white male aged seventy, complained of difficulty in swallowing and loss of 20 lb. in weight during the month preceding admission. Some pain was experienced behind the sternum on swallowing solid food for three months before admission. The symptoms gradually became worse and solid food began to "stick" and not go down. He would have a choking sensation, and regurgitate food recently swallowed. When first seen he experienced no trouble swallowing liquids. Physical examination revealed a somewhat emaciated individual, but otherwise no abnormalities other than a small degree of dehydration of the tissues. Laboratory findings showed the red blood count to be 3,710,000; the albumen, 1 plus; and the blood Wassermann test, 4 plus.

An x-ray examination following the ingestion of a small amount of barium revealed an obstructive lesion at the junction of the lower and middle third of the esophagus, and extending downward from 8 to 10 cm. There was dilatation of the esophagus above the point of obstruction, and a suggestion of a central crater within the tumor mass.

Esophagoscopy revealed considerable food lying just above the point of obstruction. The mucosa presented a granular, irregular, friable mass which bled easily. A biopsy revealed the tumor to be a squamous-cell carcinoma.

An exploratory thoracotomy was performed through the left chest wall. A hard swelling of the esophagus was found to begin 1 in. above the diaphragm and to extend 3 in. upward. The tumor had invaded the lung and the anterior surface of the aorta by direct extension. There were also two nodules in the posterior mediastinum which were adherent to the lung margin. The tumor was considered inoperable. The chest wall was closed and a gastrostomy performed.

The final diagnosis was squamous-cell carcinoma of the medullary type involving the lower third of the esophagus, with involvement of the lung and aorta by direct extension, and with metastases to the posterior mediastinum.

CASE 2. J. M., a white male aged sixty-four, complained of dysphagia with regurgitation of food for eight months. The patient's first trouble began with the swallowing of buckwheat grits, which "stuck" in the lower chest after swallowing. This symptom occurred off and on for five months, after which time it became continuous and he could swallow only soft foods or liquids. He received 26 x-ray treatments but with no relief. He lost much strength and about 20 lb. in weight. There was no history of tarry stools or hematemesis.

A physical examination revealed a markedly emaciated patient, but there were no other definitely abnormal findings. Laboratory tests were normal.

Fluoroscopic and x-ray examination following the ingestion of barium revealed a high degree of stenosis of the lumen of the esophagus from an obstructive lesion at its lower end. Polypoid lesions here replaced the normal rugæ. There was some dilatation of the lumen above the obstructive lesion. A differential diagnosis between carcinoma of the stomach and of the lower end of the esophagus could not be definitely established. Since there was no evidence of distal metastases, an exploration was advised. This was performed through the abdominal wall, and a hard immovable tumor mass was found, which involved the cardiac end of the stomach and extended upward into the esophagus. Regional lymph nodes and the liver revealed evidences of metastases, the lesion thus being inoperable. A gastrostomy was performed. The final diagnosis was carcinoma of the cardiac end of the stomach and involvement of the lower end of the esophagus by direct extension, with metastases to the regional lymph nodes and liver.

CASE 3. J. L., a white male, sixty-four years of age, complained of dysphagia beginning three months before admission. At its onset, discomfort was produced only by the ingestion of solid food. His condition gradually became worse, and during the two weeks before admission, difficulty was experienced on swallowing liquids and regurgitation occurred immediately following deglutition. There was no history of hematemesis or pain (except discomfort attending the act of swallowing). Since the patient had been on a milk diet, he had become constipated. He had lost 40 lb. in the three months prior to admission (196 to 156), and experienced a marked loss of strength. He had received five x-ray treatments two months prior to admission, without benefit.

A physical examination revealed a chronically ill appearing man who was poorly nourished and somewhat dehydrated. Other than an emphysema of the lungs, no other abnormality was found. Laboratory tests were normal.

A roentgenogram of the esophagus following the ingestion of barium revealed a high grade of obstruction caused by a lesion located just above the diaphragm. There was a small amount of dilatation immediately above the point of obstruction.

Esophagoscopy revealed a nodular friable mass which bled easily and almost completely obstructed the lower end of the lumen. A biopsy exhibited a squamous-cell carcinoma of the esophagus.

Since there was no evidence of spread of the tumor, an exploratory laparotomy and gastrostomy was performed. Two weeks later the tumor was examined through a thoracotomy opening. A hard mass involving the esophagus over a distance of 5 cm., extending upward from a point 1½ in. above the diaphragm, was found. It was densely adherent to the soft structures anterior to the bodies of the vertebræ. Through an opening made in the diaphragm, two suspicious-appearing lymph nodes located at the cardiac end of the stomach were removed. The tumor was freed from the vertebræ, care being taken to include as much of the posterior adjacent tissue as possible. The esophagus was brought out through a separate incision at the base of the neck anteriorly, following the closure of the wound in the thorax. The convalescence which followed was uneventful. The final diagnosis was carcinoma of the lower third of the esophagus with involvement of the posterior adjacent tissue by direct extension, and with metastases to the cardiac lymph nodes at the lesser curvature of the stomach. A resection of the entire thoracic

esophagus was performed instead of an esophagogastrostomy in this case because of the location of the tumor, which extended almost to the aorta; thus insufficient esophagus remained above the tumor for anastomosis with the stomach.

CASE 4. C. J., a white female fifty-three years of age, complained of dysphagia of three months' duration. Solid food seemed to "stick down near her stomach." At times, liquid foods seemed to cause more trouble than did solid. Regurgitation of material would relieve the sensation of a lump near the stomach. This contained only recently ingested food. There was no history of hematemesis or pain. The patient stated that she felt weak and tired most of the time. She had lost 8 or 9 lb. in weight.

Physical examination revealed a frail-appearing woman (weight 82½ lb.) who was dehydrated and undernourished. There were no other abnormal findings. Laboratory tests showed an anemia with a red blood count of 3,100,000 and hemoglobin, 51 per cent.

A roentgenogram following the ingestion of barium presented an obstructive lesion of the lower 6 cm. of the esophagus. The obstruction was only moderate in degree and no dilatation above the obstruction was seen. A narrow canal through the point of obstruction was irregular, and normal rugæ were absent. A diagnosis of carcinoma of the lower end of the esophagus was made.

After preparing the patient by improvement of the nutritional state and replacement of blood and fluid loss, an exploratory thoracotomy was performed. A hard mass was found in the terminal 2½ in. of the esophagus. No mediastinal lymph-node involvement was demonstrable. Through an opening made in the diaphragm the stomach and esophagus were mobilized, and after division of the gastric artery between clamps, three cardiac lymph nodes were brought up with the cardiac end of the stomach. About 6 cm. of terminal esophagus and 2½ in. of the cardiac end of the stomach were resected. The esophagus was then anastomosed with the fundus of the stomach. A gastrostomy was performed, and the thoracic wound closed. Convalescence was uneventful. The final diagnosis was squamous-cell carcinoma of the medullary type involving the terminal 2½ in. of the esophagus, with metastases to the regional cardiac lymph nodes.

DIAGNOSIS

In most cases, the diagnosis presents little or no difficulty, at least not in the stage when the patient first seeks attention. Unfortunately, symptoms have usually been present for a period of several months and successful surgical management is already questionable. The latent course of this tumor is long and no symptoms are manifested until a sensation of obstruction is noticed during the act of swallowing. If ulceration occurs in the central portion, as in the medullary type, the degree of obstruction is less severe, and for this reason, the lesion may become quite large before producing symptoms. Knowing the frequency of the lesion, we therefore need to be on the lookout in order that a correct diagnosis may be made as early as possible. According to Huenermann, in a large series of cases symptoms were present for five and nine-tenths months before a correct diagnosis was established. Four of the 5 described cases were seen three months after the onset of symptoms, the fifth being eight months in duration before definite diagnosis was established. Several factors are characteristic in the symptomatology of this condition.

1. Disturbance of deglutition is almost routinely observed as the first evidence of the disease. This may be present with or without regurgitation of food, and in contrast to diverticula of the esophagus, it causes regurgitation of only recently swallowed food, which is accompanied by no unpleasant odor. The symptoms which are caused by the obstruction are produced by the intensified peristaltic movements, made by the esophageal musculature in attempting to overcome the obstruction. Thus, a sensation is experienced of the food "sticking" in this region. The obstruction is due to infiltration of the wall of the organ, which interferes with function by virtue of the anatomical as well as the physiological changes.

2. Pain. This is usually entirely absent with the exception of discomfort experienced due to the obstruction to swallowed material. Since the esophagus contains no pain sense nerve endings, only a feeling of pressure or distention is experienced.

3. Loss of weight and strength. This is chiefly due directly to the lack of ingested food with or without regurgitation. Loss of appetite is a variable factor, and not always present.

Physical findings. Other than loss of weight and strength and dehydration, no abnormal findings are manifested during the period when successful surgical management is possible. It is only after the tumor has involved adjacent structures by direct extension or distal parts by metastases, that abnormalities are found on physical examination.

Fluoroscopic and x-ray findings following the ingestion of barium are almost pathognomonic in this tumor. Marked constriction of the lumen with an irregular tract through the central portion of the tumor replaces the normal contour of the mucous membrane of the esophagus. In many cases, a considerable degree of dilatation is present above the point of obstruction. These characteristics may be demonstrated more easily with the barium mixture somewhat thicker than is ordinarily used for visualization of the stomach and small intestine.

Esophagoscopy. The appearance of the lesion is quite characteristic. The obstruction is abrupt, and although the mucosa may be intact, as is not infrequently the case in the scirrhous variety, the appearance of a pale, abnormal, irregular lining is strongly suggestive of a malignant neoplasm. A biopsy including the full thickness of the mucosa

will usually demonstrate definite evidence of carcinoma.

In order to arrive at a correct diagnosis while the tumor is still operable, examination with x-rays and by esophagoscopy in all cases presenting disturbances of deglutition should be made.

Benign obstructive lesions of the esophagus are occasionally seen. They may be exceedingly difficult to diagnose and the etiological factors may be obscure. Differentiation from malignant disease must be determined primarily by means of the esophagoscope and roentgenograms following the ingestion of barium.

TREATMENT

In spite of the increasing interest in surgical management of esophageal carcinoma, and the more frequent exploration of these patients than heretofore, our knowledge has not yet reached the stage of development where operability can be determined by physical and laboratory examinations and the diagnostic methods now available. In this respect, nothing very definite can be gained from a knowledge of the duration of symptoms. Obstructive symptoms may be present for a variable length of time, before direct spread or metastases occur. Likewise, it is difficult to know how long the tumor has been present before symptoms develop. Loss of weight, which results chiefly from the lack of ingestion of sufficient food, is no indication of dissemination of the tumor beyond the operable stage. On the other hand, the tumor may extensively invade essential structures before symptoms due to obstruction of the lumen or from direct extension become manifest. Again, metastases may be widespread, and yet remain entirely silent.

Pre-operative preparation. Because of the degree of severity of undernourishment and dehydration which attends obstruction of the esophagus, a thorough preparation for operation is imperative. Solid food should be eliminated from the diet, malnutrition and dehydration being overcome by both the oral and intravenous administration of fluids containing salt and high in caloric content. Not infrequently, blood transfusions are indicated. Attention to preparation before the operation has contributed much to the successful surgical management. A preliminary jejunostomy prior to resection of the esophagus is usually unnecessary. Most of the patients are between the fifth and sixth decade of life, and following major operations the danger of postoperative pneumonia is considerable. For this reason a search is made for evidence of an upper respiratory infection and attention is given to oral hygiene.

Anesthesia. The choice of anesthesia is very important. Great stress has been placed by some authors on the necessity of intratracheal positive pressure anesthesia for intrathoracic operations. The importance of this type of anesthesia in some instances is not to be denied. It has also undoubtedly given surgeons a sense of security in carrying out intrathoracic operations. It has long since been known that most intrathoracic operations may be done and some more easily under simple mask gas-oxygen (especially ethylene-oxygen or cyclopropane-oxygen) inhalation anesthesia, the pressure obtained thereby being ample for maintaining inflation of the lungs for sufficient gas exchange. It also allows sufficient collapse of the lungs to give adequate exposure for carrying out the operative procedures. The danger of introducing mouth organisms into the tracheobronchial region during intubation, with resultant postoperative pneumonia, has been discussed by some authors (Reinhoff), and is a factor to be kept in mind. Ohshawa has emphasized the value of open thoracotomy for operations on the thoracic esophagus because of better exposure obtained with relaxation of the lung. We have used simple mask ethylene-oxygen anesthesia for various intrathoracic operations, and have found it unnecessary to employ an intratracheal catheter. The anesthetist should be prepared, however, for an emergency intubation, should the need occur. When the operation is completed, the remaining surgical pneumothorax is obliterated by aspiration of the air with a catheter rather than by distention of the lung by means of high positive pressure.

Prevention of contamination. As in other intrathoracic operations, protection of the wound edges aids in the prevention of contamination, and helps to insure primary healing following the operation. This is especially important in resection of the thoracic esophagus, since it contains highly infectious material. Many of these tumors have a central foul necrotic area containing a mixed culture of organisms. Preliminary to the division of the esophagus, the surrounding structures should be protected with moist sponges, and contamination prevented as much as possible by swabbing the cut end of the esophagus with tincture of iodine. The factor of infection cannot be overemphasized, since it has been one of the major causes of failure of surgical management.

Selection of type of operation. This is determined chiefly by the location of the tumor. Two types of resection have been carried out successfully:

1. Resection of the entire thoracic esophagus after inversion of the lower stump by a purse-

string suture. The upper end of the esophagus is brought out through a stab wound in the neck, thus producing a fistula of the cervical esophagus. This is later connected to a gastrostomy opening by means of rubber and glass tubing. This type of procedure may be used in all cases of carcinoma of the esophagus, the report of the first successful case being made by Torek. Most of the early successful resections performed in the United States and in Europe have been of this type.

2. This type consists of the resection of a segment of the lower esophagus, following which the fundus of the stomach is brought up into the thorax through an opening made in the diaphragm, and an end-to-side anastomosis made with the upper cut end of the esophagus. In this way, a reëstablishment of the alimentary tract is effected following the resection of the tumor. This second type of operation can be employed only when the tumor is located far enough below the arch of the aorta to enable the suturing of the stomach to the cut end of the esophagus. When possible, the second type of operation is probably more satisfactory, since it allows the ingestion of food in the customary way without necessitating constant attention to esophagostomy and gastrostomy wounds. On the other hand, patients may live in comparative comfort for many years with an artificial esophagus made of rubber and glass tubing. In either type of operation, attention must be given to direct extension of the tumor, as well as to metastatic lesions. All suspicious tissue in the neighborhood of the tumor should be excised. Whether the first or the second type of operation is employed, the diaphragm should be opened through the thoracic approach and all suspicious glands in the region of the cardia removed. This applies also to the mediastinal lymph nodes.

Postoperative management. A blood transfusion should always be given during the operation and further transfusions may be indicated during convalescence. Supportive measures including nourishment by intravenous and subcutaneous administration not only will insure sufficient caloric intake, but will maintain water and mineral balance. Obliteration of surgical pneumothorax and elimination of serosanguineous exudate by continuous low-grade suction will help to prevent infection and will aid materially in obtaining primary healing.

SUMMARY

The frequency of carcinoma of the esophagus has only recently become appreciated. That it is a very common tumor is indicated by the fact that it ranks fourth in incidence of all malignant tumors in men over twenty years of age. Thus, it presents one of the major problems in tumor therapy. Treatment of this condition has met with almost complete failure until recent years. Successful operative management is gradually increasing. Progress in successful surgical management depends almost entirely on early diagnosis. Inasmuch as these tumors remain silent until mechanical obstruction of the lumen occurs, early diagnosis is difficult. It is not until the profession as a whole becomes well aware of these facts, and is on the lookout for the earliest symptoms, that much progress will be made. Education of the public regarding tumors in general has had considerable influence, and with further effort, more may be expected.

ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

EYE

Sugar, H. S.: Concerning the Chamber Angle. I. Gonioscopy. *Am. J. Ophth.*, 1940, 23: 853.

Notwithstanding the important pioneer studies of the angle of the anterior chamber, made during the past thirty-seven years, it has remained for Barkan, with his newer methods of gonioscopy, to create a practical interest in this phase of ophthalmology. With the awakening has come a demand for more precise knowledge of the technique, anatomical interpretation, and practical application of this method of examination.

From his studies and observations on 102 cases, the author concludes:

1. The normal angle of the anterior chamber has definitely recognizable characteristics, which depend to some extent on the color of the iris. When trabecular pigment is present, its source is always the pigment epithelium of the iris. Its relation to glaucoma is still an unclarified point.

2. Gonioscopy is an important adjunct to thorough ophthalmic examination. It is of particular value in studying anomalies, neoplasms, cysts, and the results of trauma involving the angle. Perhaps most important is its use in studying postoperative glaucoma, particularly in determining the reasons for surgical failure.

3. Peripheral anterior synechiæ are present in a large number of eyes operated upon to relieve glaucoma. These add to the embarrassment of previous drainage channels but are significant only when the new surgically formed channels are inadequate. They must be considered in contemplating secondary surgery.

4. Peripheral anterior synechiæ are not present in early and even moderately advanced compensated cases of glaucoma which have never been incompensated at any time. They occur only late in the glaucomatous process, probably beginning with edema of the ciliary body during an episode of incompensation.

LESLIE L. MCCOY, M.D.

Lijó Pavía, J.: Initial Lesions of the Macula Observed with Sodium Light (Lesiones iniciales de la mácula observadas con la luz de sodio). *Rev. olo-neuro-oftalmol. y de cirug. neurol. sud-americana*, 1940, 15: 235.

Lijó Pavía states that examination of the macula with the sodium light reveals slight changes even before the patient has experienced subjectively the slightest decrease in vision. He presents 4 observations in which the small size of the lesions (a few tenths of a millimeter) has at times made it very difficult to obtain their photographic reproduction.

In a case of mental overwork with vision corrected to normal, examination of the macula with ordinary light showed that its limiting reflection was irregular and that it contained numerous brilliant points, especially in the left eye; the foveal reflection was dissociated although the dark red spot of the fovea could be distinguished clearly. With sodium light, the macular reflection was slightly irregular and the presence of cholesterol dots could just be seen on its temporal border. The macular region gave the impression that its internal limiting border presented an interruption in front of the fovea and that the border of the latter was marked by a series of small yellowish white, brilliant spots; between these appeared the foveal reflection, which was very brilliant, reversed, and of a size ten times larger than the afore-mentioned spots. More spots of the same type were seen in the remainder of the macular region.

In another case in which the subject was experiencing subjectively a decrease of vision in the left eye, examination with ordinary light showed that the border of the papilla was nearly completely blurred, and that the macula was deformed and interrupted in its nasal sector. The interior of the macula seemed to be granular and presented a greenish gray spot; no foveal reflection could be observed. One year later, vision had improved slightly under treatment. Examination with sodium light revealed improvement in the temporal sector of the papilla and thickened nerve fibers in the papillomacular region, which formed folds which ran from the nasal sector of the macula to the temporal border of the papilla. The macula presented a special aspect, and a dark patch in its center allowed distinguishing of the fovea and also of the foveola. In the outer part of the macula, the reflection was more or less marked above, below, and in the temporal sector, but disappeared in the nasal sector where it was replaced by a slightly depressed and dark section limited centrally by a circle of reflection which was also incomplete in the nasal sector. The middle part of the macula, included between the internal circle of reflection and the fovea, showed numerous very small vacuoles. The greenish-gray spot in the outer part of the macula could not be seen with this light, but became visible with infra-red light and retrograde transillumination.

In an old patient with hepatic disease and subjective changes in vision, which were more marked in the left eye, examination with ordinary light showed a slight macular reflection and a fovea just visible as a pink, slightly dark zone, the center of which presented a circular loss of substance with a brilliant border which was reached by the horizontally enlarged foveal reflection. Below and inter-

nally, a cholesterol nodule the size of a large vessel, and above and externally, two spots could be observed. Sodium light showed that the macula and fovea were barely marked. The three nodules and the perforation were just visible because the slight foveal, very granular reflection was caught by what appeared as a brilliant border under ordinary light. The area of the perforation was marked by a small, more obscure zone, at the bottom of which a whitish spot could be seen with difficulty. The nodule was clearly visible. RICHARD KEMEL, M.D.

EAR

Lillie, H. I.: The Treatment of Otitis Media. *J. Am. M. Ass.*, 1940, 115: 506.

Assuming that the diagnosis of acute otitis is made correctly, what should be done? The patient should be hospitalized and confined to bed in a nearly upright position. The room should be warm and moist. Appropriate treatment of any respiratory infection should be instituted and it must be insisted that the patient not blow the nose. Hot moist dressings applied over the ear and mastoid are effective in ameliorating symptoms. Roentgenological treatment of the ear in the early stages of the condition has been found to afford considerable relief of pain for many patients.

There seems to be no unanimity of opinion regarding the indications for and usage of myringotomy in suppurative otitis media. If myringotomy is deferred, any of the standard medicaments may be used in the ear. In addition to the effect it has on the pain, the use of a medicament helps partially to sterilize the canal. During this period other necessary examinations may be carried out. If myringotomy is decided on as a primary method of treatment, the operation is best performed under general anesthesia. An adequate incision of the tympanic membrane, not merely a puncture wound, should be insisted on.

It is my opinion that it is best not to resort to irrigations of the auditory canal if the discharge from the ear is free. Irrigation of the auditory canal should not be done until the discharge becomes thick and purulent. Hot moist compresses should be applied over the ear and the mastoid process because their use seems to encourage free discharge.

Careful observation of the body temperature, pulse, and respiration, and the use of laboratory tests are essential because the progress of the patient may best be followed if these observations are correlated.

The use of sulfanilamide is rather general at present, and the literature is filled with strikingly successful instances of its use. On the other hand, it is equally true that warnings are being sounded by very competent observers to the effect that the use of the drug may seriously mask the signs and symptoms of actual underlying pathological processes.

In general, it can be said that the treatment of chronic suppurative otitis media should be carried out by an otologist. The frequency of treatment is entirely dependent on the nature of the disease. Treatment must be persistent, well directed, and meticulous. To wash out the discharge with aqueous solutions is not good treatment; the use of alcoholic solutions is preferable. Manipulation with instruments may be necessary to remove collections of desquamated material, aural polyps causing obstruction to underlying cavities or recesses, and exuberant granulation tissue. At the first visit of the patient it may not be possible for the otologist to do all he would like to do because the patient may be too apprehensive. As confidence is gained, more can be accomplished. From an economic standpoint, persistence in local treatment may be favorable from the patient's point of view. If the treatment is not entirely successful and surgical intervention is decided on, it will be found that the local treatment has prepared the field well and that the period of postoperative treatment will be much less prolonged for that reason. Treatment at home under the direction of the otologist is not effective until the pathological process has been brought well under control.

Patients affected with chronic suppurative otitis may be divided clinically into four groups. The clinical management of each group is based on the recognition of the underlying pathological process.

NOSE AND SINUSES

Brunner, H., and Wall, J. W.: Carcinomatosis of the Nasal Mucous Membrane (Fatal Hemorrhage After Puncture of the Maxillary Sinus). *Ann. Otol., Rhinol. & Laryngol.*, 1940, 49: 688.

The case which the authors describe presents a metastatic malignancy of the nasal mucous membrane, but without the development of a tumor-like formation. In a fifty-four-year-old white male, a puncture of the right antrum was made under the inferior turbinate, and a small amount of pus, with considerable bleeding, was obtained. The extreme pallor of the patient, who had given a history of back pains, in addition to the "butter-like" consistency of the nasal wall felt at puncture, convinced the authors that they were dealing either with a carcinoma and multiple metastases in the skeleton, or with a myeloma.

Following puncture, there was a small amount of bleeding. This was controlled by a nasal pack. The same afternoon severe epistaxis occurred, but this again was controlled. The patient, however, showed signs of internal bleeding and began to vomit large amounts of fresh blood. Repeated nasal examinations exonerated the nose as the specific offender. Despite two blood transfusions, the patient died the following morning, about twenty-four hours after puncture of the antrum. An autopsy was performed and the anatomical diagnosis was diffuse carcinoma of the lesser curvature of the stomach with metastases to the liver, regional lymph nodes, meninges, and calvaria; hemorrhage from carcinoma of the stomach; right suppurative maxillary sinusitis; bilateral patchy atelectasis of the lungs; and an old

healed tuberculosis of the apices of the lungs. Gross examination of the head revealed an area of softening in the inner table of the parietal bones, and a partial clotting of the venous sinuses of the dura.

In the microscopic examination, carcinoma cells were found within the blood vessels of the nasal mucous membrane; onkocyte cells were observed in the nasal glands; but the most outstanding feature was the finding of emboli within the veins and lymph vessels of the nasal mucous membrane, consisting of cells with large nuclei and somewhat irregular margins of their protoplasm. Finally, the authors believe that they can explain the gastric hemorrhage thus: the antrum puncture and irrigation caused an irritation to the mucous membrane of the antrum, which in turn reflexly caused some disturbance in the circulation. This circulatory change forced too great a load on the blood vessels of the tumor in the stomach, which already were weakened by the tumor, and they ruptured, causing the hemorrhage and subsequent death of the patient.

NOAH D. FABRICANT, M.D.

MOUTH

Kohn, S. I.: Facial Fistulas of Dental Origin. *Am. J. Orthodont. & Oral Surg.*, 1940, 26: 797.

An external fistula may result from an apical abscess or cyst of a tooth. The true nature of these fistulas is frequently not recognized; the proper care of the condition requires the coöperation of the physician and dentist.

The appearance of these fistulas may not be preceded by any particular pain or discomfort, but on the other hand swelling and pain may be great.

Judicious packs and hot saline mouth washes may prevent rupture of the abscess externally; intra-oral drainage of the abscess is desirable. However, if the abscess points externally, incision below the mandible is desirable, as the scar is less noticeable.

Should a fistula develop after the acute infection has subsided, the affected tooth should be removed and the granulations gently curetted. This usually results in prompt closure of the external sinus.

LUTHER H. WOLFF, M.D.

Martin, H. E., Munster, H., and Sugarbaker, E.: Cancer of the Tongue. *Arch. Surg.*, 1940, 41: 888.

A series of 556 consecutive unselected cases of cancer of the tongue have been subjected to intensive clinical analysis and report. At the Memorial Hospital cancer of the tongue comprises about 15 per cent of all tumors of the upper respiratory and alimentary tracts and about 25 per cent of all intra-oral tumors. In the series herein reported, the average age of the patients was about fifty-eight years at the time of admission to the hospital. Eighty-seven per cent of the patients were males and 13 per cent were females. There is general agreement that the most frequent site of origin is the edge of the tongue in its middle third (50 per cent in the authors' series).

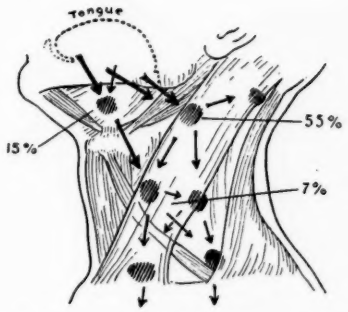

Fig. 1. Pathways of metastasis in cancer of the tongue. The figures express the frequency of initial involvement in certain areas.

Such characteristic signs of chronic irritation in the oral cavity as leucoplakia, chronic glossitis, and dental sepsis are much more prevalent in the male than in the female. The fact that cancer of the oral cavity is likewise more frequently found in the male is one of several evidences of a direct causal relationship between chronic irritation and intra-oral cancer. Undoubtedly the chronicity of the irritant is more important than its nature.

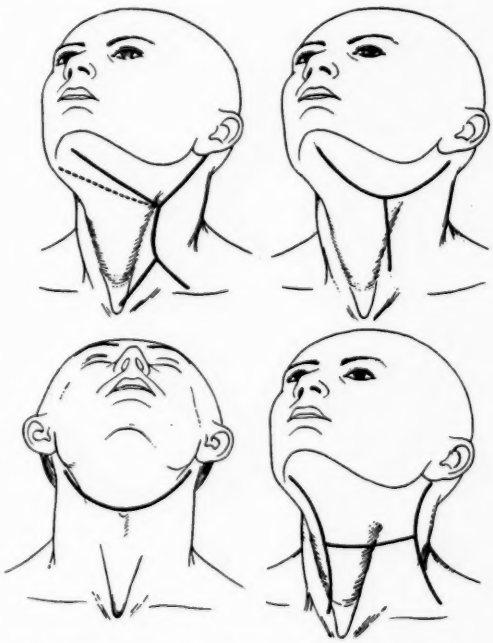

Fig. 2. The most useful forms of incision for neck dissection.

Differentiating, keratinizing squamous carcinomas and relatively non-keratinizing mucous membrane types of epidermoid carcinoma comprise about 90 per cent of the malignant tumors of the tongue which occur anterior to the circumvallate papillæ. About 80 per cent of carcinomas of the base of the tongue are of the non-keratinizing variety, and in this region anaplastic tumors occur in larger proportion. Transitional cell carcinomas and lymphepitheliomas comprise about 20 per cent of the tumors at the base.

In the majority of instances the patient discovers the lesion by the tactile and visual senses alone and not because of any actual discomfort. Other first symptoms, in the order of their frequency, are as follows: the development of palpable cervical nodes, hoarseness, dysphagia, or dyspnea (when the base of the tongue is involved), and pain, tenderness, or irritation ascribed to sharp teeth or ill-fitting dental plates. A cancer at the base of the tongue may ulcerate and reach a size of 3 cm. or even more without causing any particular noticeable local symptoms.

In the series of cancers of the tongue reported here, the incidence of metastases on admission was about 39 per cent. The group of lymph nodes earliest and most frequently involved is the upper deep cervical (55 per cent), which is centered about at the bifurcation of the common carotid artery (Fig. 1). Dissemination below the clavicle to the viscera or other soft parts and to bone is far more frequent in cancer of the tongue than in cancer of the lip or cheek. Visceral metastases are particularly likely to follow growths of the base of the tongue, where anaplastic tumors are common.

About 30 per cent of all cancers of the base of the tongue in the clinic at the Memorial Hospital are referred because of cervical lymph-adenopathy with the primary lesion undiscovered. It should be remembered that most cervical adenopathies in the adult are malignant and probably metastatic from cancer primary in the oral cavity or in the oral and nasal pharynges.

In a case of chronic ulcer of the tongue, a positive Wassermann reaction does not disprove the presence of cancer, since syphilis and cancer of the tongue coexist in about one-third of all cases. Since gumma of the tongue is rare (the incidence is less than 1 per cent of that of cancer of the tongue), it seems illogical to employ the therapeutic test without first making a biopsy. It is certainly unwise to persist in the therapeutic test for longer than three weeks. The relative frequencies of cancer, tuberculous ulcers, and gumma of the tongue, according to the admission records of the Memorial Hospital, are about 100, 3, and less than 1, respectively. A diagnosis of a tuberculous ulcer is made with the aid of biopsy (preferably repeated), a roentgenogram of the chest, and examination of the sputum. A correct diagnosis is especially important, since the proper treatment for cancer is almost the worst possible treatment for tuberculosis, and vice versa.

It is unfortunate that the current medical literature should still contain reports attempting to prove the superiority of one method alone—either radiation or surgical therapy—in the treatment of cancer of the tongue. In the treatment of cancer of the tongue, three distinct problems must be considered: (1) the hygienic care of the oral cavity before and during treatment; (2) the treatment of the primary lesion, and (3) the treatment of cervical metastases.

Among the general hygienic measures, proper dental care, irrigations of the oral cavity with mildly alkaline saline solutions, nasal feedings, vitamin therapy (especially B and C), and the administration of liver extract, either perorally or intramuscularly, must be mentioned.

Methods of treatment used at the Memorial Hospital for the primary cancer of the tongue are:

A. Radon seeds alone for very small early lesions.

B. Fractionated peroral roentgen irradiation supplemented by radon seeds—the most useful method for all except the very small growths of the anterior two-thirds of the tongue.

C. Fractionated roentgen irradiation through the neck followed by supplementary radon seeds for cancer of the base of the tongue.

D. Radon seeds ("overdosage") followed in from five to ten days by partial glossectomy. This method is indicated only for a limited number of bulky, fungating, partly necrotic tumors.

E. Variations in technique:

1. Roentgen irradiation alone. This may be successful with a limited number of very radiosensitive tumors. Supplementary interstitial irradiation is probably indicated in all cases.

2. Low voltage, lightly filtered peroral roentgen irradiation. This form of treatment should be limited to the very superficial growths on the anterior portion and dorsum of the tongue.

3. Surgical excision alone without either preliminary or postoperative irradiation. This procedure has a very small field of usefulness and should be limited to the fungating papillary tumors at the tip of the tongue.

Methods of treatment used at the Memorial Hospital for cervical metastases are as follows:

1. Protracted external irradiation through small portals followed by the implantation of radon seeds. This method is the most generally useful for treatment of all cervical metastatic cancer.

2. Radical neck dissection (Fig. 2). This method has a limited application but is very useful when indicated.

3. Radon seeds alone. This method is indicated only for very small or isolated nodes.

4. External irradiation alone. This method is useful only in very radiosensitive tumors.

5. Variations and combinations of technique:

A. Surgical exposure and implantation of radon seeds.

B. Implantation of radon seeds in heavy dosage followed in from ten to fifteen days by surgical excision.

C. Surgical excision followed by radon-seed implantation for an irremovable residuum.

The complications following surgical procedures are apt to be acute and severe but of short duration; those following radiation treatment tend to be of lesser degree (at least in the beginning) but of longer duration. Radionecrosis of limited extent may often be dealt with by local conservative measures, such as mouth washes, irrigations, sprays, and the daily removal of the slough, but in the case of persistent or widespread involvement convalescence is shortened by partial glossectomy, in which the devitalized area with fair margins of viable tissue surrounding it should be removed. In all hemorrhages from cancer of the tongue, prompt ligation of the vessels of the neck is indicated. The blood supply of the anterior portion of the tongue is derived from the lingual artery, with the addition of the tonsillar branch of the facial artery (external maxillary) which in part supplies the base. It is usually recommended in surgical texts that all of these vessels be approached by an incision through the submaxillary triangle, but the authors believe that they are best exposed for ligation at the bifurcation of the common carotid artery, which lies under the anterior edge of the sternomastoid muscle, a little below the level of the angle of the jaw. Radio-osteomyelitis of the jaw should be treated conservatively, at least until the probable extent of the sequestration can be determined. The complication is less serious in the upper jaw than in the lower. Partial resection of the mandible may be necessary in cases of aggravated lesions.

JOSEPH K. NARAT, M.D.

PHARYNX

Figi, F. A.: Fibromas of the Nasopharynx. *J. Am. M. Ass.*, 1940, 115: 665.

From January 1, 1910, to January 1, 1940, 63 patients having fibromas of the nasopharynx have been examined at the Mayo Clinic. The entire group of 63 includes only patients who had fibromas of the juvenile basal type. Fifty-eight of the tumors occurred in male patients; 5 in female patients. The patients ranged in age from ten to thirty-one years at the time of examination.

Data concerning some of the patients encountered prior to 1919 were incomplete and because of this only 45 cases, in which the patients were seen since that date, were reviewed in detail.

The extent of these tumors varies greatly. Although they usually spring from some point of origin situated high on the posterior wall or the vault of the nasopharynx, in our experience comparatively few of them were limited to this cavity at the time the patient reported for examination. The inherent activity of the growth, together with the stimulation induced by repeated incomplete treatment previously carried out in the majority of these cases, unquestionably was a factor in such extension beyond the afore-mentioned cavity. The nasopharynx was involved in all 45 cases in this series which were studied in detail, but in only 11 cases were the tumors confined to this region alone. Both nasal fossæ were involved in 3 cases, the left alone in 18 instances and the right in 13.

Removal of tissue from these tumors is always attended by profuse bleeding and in some of the more recent instances of the condition biopsy was not performed, the diagnosis being based on the history, the age of the patient, the hardness of the tumor, and the characteristic clinical picture. Surgical removal of these tumors involves considerable risk, and recurrences are frequent. The implantation of radium and electrocoagulation supplemented with radium are the most effective forms of treatment in these cases. By means of electrocoagulation and the insertion of radium a tumor of this type can at times be eradicated with a single application, but fewer complications are likely to be encountered if treatment is carried out in stages. There was no mortality in the series. All the patients who received complete therapy are now well, with the exception of 1 male patient, sixteen years of age, who is still receiving treatment at the time of writing.

NECK

Niño, F. L.: Papilliferous Cystadenolymphomas of the Neck (Cistoadenolinfomas papilíferos del cuello). *Bol. inst. de clín. quir.*, Univ. de Buenos Aires, 1940, 16: 271.

The author has been director of the Laboratory of the Clinicosurgical Institute of the University of Buenos Aires for eleven years. During that time he has had occasion to examine 6 cases of papilliferous cystadenolymphoma of the parotid region, all of which are described in detail in this article and illustrated with reproductions of the histological findings. Previous to this publication only 18 cases of this form of tumor have been described in Argentina. This doubtless does not represent the entire number that have occurred, for many have probably not been published.

Among the 86,000 patients examined in this Institute only 70 had tumors of the parotid glands which were studied histologically. Eleven of these were cystic tumors and of these 7 were papilliferous cystadenolymphomas; therefore, this form of tumor constitutes 10 per cent of the total number of parotid tumors.

In the first of the author's cases the tumor was bilateral. So far as he knows this is the only case in the world literature in which this form of tumor was bilateral.

Very little is known of the pathogenesis of this form of tumor. The author discusses the different theories held in regard to it and says that he is inclined to think that these tumors are embryological in origin. He uses the name papilliferous cystadenolymphoma because it describes the histological picture of the tumors very accurately.

AUDREY G. MORGAN, M.D.

Gross, R. E., and Connerley, M. L.: Thyroglossal Cysts and Sinuses. *New England J. Med.*, 1940, 223: 616.

The authors review the findings in 198 cases of thyroglossal cysts and sinuses observed or treated at the Children's Hospital of the Harvard Medical School, Boston.

Thyroglossal cysts or sinuses are usually lined by columnar or ciliated epithelium, but the epithelium may be squamous in type. Not uncommonly there are small slit-like or irregularly branched side pockets extending from the sinuses for several millimeters into the surrounding tissue. The cysts and sinuses contain varying amounts of mucoid material unless lined by squamous cells when they contain yellow grumous or pasty material. Varying degrees of acute and chronic inflammation are found in the wall.

Study of the soft tissues and central portion of the hyoid bone removed by block dissection makes it clear that in order to be certain that the entire tract is removed a block of tissue as far upward as the foramen cecum and including the central portion of the hyoid bone must be removed.

Approximately 85 per cent of the cases studied were cysts and about 15 per cent were sinuses. In a few cases there was a deep cyst communicating with a superficial sinus which did or did not connect the cyst with the skin.

A thyroglossal cyst may be found anywhere in the midline cervical structures from the base of the tongue downward to the suprasternal notch. Almost invariably there is some deep attachment to the structures in the base of the mouth or to the underlying hyoid bone. In rare cases pressure on the cyst will express a small amount of fluid at the base of the tongue.

Thyroglossal-duct sinuses open in the midline anywhere from the suprasternal notch upward to a position just in front of the hyoid bone. In most cases careful palpation of the neck will reveal a cord of tissue running upward in the deep structures of the neck.

In 29 per cent of the patients the lesions were noted at birth and in 76 per cent the symptoms began before the sixth year. Fifty-six per cent of the patients were girls and forty-four per cent boys.

The authors give the differential diagnosis of thyroglossal cysts and sinuses. They do not believe all cases require operation. They do not believe that the use of sclerosing solutions is the proper method of treatment. Acutely inflamed cysts should not be excised.

The technique of operation for cyst or sinus is as follows:

The head should be extended. A transverse incision should always be used, care being taken to have it fall in a neck fold. The tract should be dissected to the hyoid bone; 1 cm. of the midportion of the hyoid bone is removed, and the block dissection is continued up to the base of the tongue. A forefinger passed into the mouth and pressing in the region of the foramen cecum will guide to the depth of the dissection.

Ninety-one cases were treated by the complete operative procedure including removal of the middle of the hyoid bone. None of these cases have had a recurrence. In 16 cases incomplete operative procedures were done with a 50 per cent recurrence. Six of the 8 patients with recurrence were subjected to secondary or tertiary procedures before a final cure was obtained. The 2 patients with exposed mucous membrane in the midline did not get good cosmetic results and therefore the authors recommend surgery plus postoperative x-ray therapy in these cases.

EARL O. LATIMER, M.D.

Tejerina Fotheringham, W. Sugasti, J. A., and Gurruchaga, J. V.: Lateral Aberrant Tumors of the Thyroid Gland (A propósito de los tumores aberrantes laterales de la glándula tiroides). *Bol. y trab. Acad. argent. de cirug.*, 1940, 24: 779.

Aberrant tumors of the thyroid gland are in no direct anatomical relation to the gland itself: for example, they may enter the thoracic cavity, or they may be located laterally to the gland or at the base of the tongue. They show a preference for the carotid region, underneath the sternocleidomastoid muscle, and may be unilateral or bilateral. The tumors may be encapsulated or adherent to the adjacent organs. Of 109 aberrant tumors collected from the literature, 48 were adenomas, 22 benign papilliferous tumors, 22 malignant papilliferous tumors, and 9 cancers; 8 were not classified.

The author reports 2 cases of lateral aberrant thyroid hypertrophy, one in a twenty-nine-year-old man and the other in a man fifty-nine years of age. The first tumor was removed without difficulty and proved to be a papilliferous formation. The second tumor was firmly adherent to the internal jugular vein and on histological examination was shown to be a follicular adenoma with papillary formation.

JOSEPH K. NARAT, M.D.

Lindsay, J. R.: Laryngocele Ventricularis. *Ann. Otol., Rhinol. & Laryngol.*, 1940, 49: 661.

The term "laryngocele ventricularis" in man refers to an air sac which sometimes develops from the appendix or saccus of the ventricle of the larynx. It has been found to develop in three ways. The most common is the internal laryngocele, a cystic dilatation appearing within the larynx above the false cord. The cyst dilates on forced expiration and if large may produce obstruction. It deflates on quiet respiration but may persist for some time. Hoarseness accompanies dilatation of the sac. The second type is the superior external laryngocele, in which type the sac has perforated through the thyrohyoid membrane and appears as a swelling in the neck. The swelling enlarges on coughing, physical exertion with the upper extremities, or straining at stool. Distention of the sac may be accompanied by local discomfort and headache. If there is no accompanying internal laryngocele the voice will not be

impaired. The third type is a combined internal and external laryngocele.

A study of those cases described in the literature, as well as of the case reported by Lindsay, indicates that there has been one common exciting factor in all of them, namely, an elevation of the air pressure within the glottis, to which the ventricles and the appendices which extend from the ventricles are exposed. The position of the true vocal cords during phonation can be observed by direct or indirect examination. During quiet respiration with full relaxation there is a broad aperture between both the true and false cords. During phonation of the letter "E" the true cords are approximated, while the false cords remain far apart. Phonation of "E" on inspiration also shows the false cords to be separated. Closure of the glottis on inspiration may show only the true cords to be in apposition, but if the glottis is more firmly closed, both false and true cords come into apposition. During strenuous muscular activity, the glottis is firmly closed by both false and true cords. During still more strenuous closure of the glottis, both false and true cords are in apposition. During swallowing the larynx is raised and both the true and false cords are brought into firm apposition.

Roentgenological examination with the planograph seems to indicate that closure of the glottis during strenuous muscular movements of the upper extremities, during straining, and during the early part of coughing before the glottis opens is brought about partly by closure of the true cords, but to a much greater degree by the sphincteric action of the muscles surrounding the upper aperture of the larynx. Further, the glottis is closed in such cases to prevent the escape of air rather than to prevent inspiration. The intratracheal pressure is increased, and the pressure becomes transmitted to the ventricles, apparently because the true cords afford less resistance than the upper sphincter. The shape taken by the ventricular bands during apposition would preclude any involuntary action as an outlet valve. Closure must be maintained by muscular action. It also appears that in delivering very loud, sharp sounds, the intratracheal pressure is increased at the onset of the tone. This is accomplished by closure either at the level of the palate or by closure of the glottic sphincter, or both, and in either case the ventricles will be exposed to the increased pressure since the true cords provide relatively weak resistance.

Whether laryngocele develops as a direct hernia through the laryngeal wall, represents an inherited tendency, or develops as a result of a congenital weakness is still a matter of discussion. It appears very likely, however, that the condition develops in individuals with a congenital predisposition to it. The necessary exciting factor, namely, unusually high intraglottic pressures, is one which is commonly found in most individuals.

NOAH D. FABRICANT, M.D.

BRAIN ABSCESS

Collective Review

FRANCIS C. GRANT, M.D., F.A.C.S., Philadelphia, Pennsylvania

UNTIL Morgagni, in the eighteenth century, showed that brain abscess resulted from disease of the mastoid or other sinuses, medical opinion held that infection in these cavities was due to an attempt of the abscess to rupture through to the surface. Massa in 1533 and Fabricius Hildanus in 1606 have recorded cases of brain abscess, and Glandorp and later Boirel in 1677 speak of post-traumatic abscess of the brain which was trephined and drained with ultimate recovery. Bonetus in 1700, in his *Sepulcretum*, records autopsy findings of this condition. Morand, in 1750, successfully trephined over a carious fistula and drained a left temporosphenoidal abscess due to mastoid infection. Stoll in 1780 describes his experiences with several cases of brain abscess. Abercrombie, Cruveilhier, Hooper, Bright, and Itard early in the nineteenth century made contributions on this subject. In 1848, Roux enlarged the discharging sinus track, and drained and cured a right temporosphenoidal abscess following infection of the mastoid.

Lebert in 1856, in the first systematic account of brain abscess, collected a series of 80 cases from all sources, including 5 of his own. He speaks decisively against surgery as a method of treatment. In 1881 Macewen opened a left temporosphenoidal abscess by trephining through the temporal bone. Although the patient died, this would seem to be the first case in which an otitic brain abscess was opened during life without the guidance of a fistula. In 1885, Schondorff and, in 1886, Truckenbrod each reported the successful evacuation of a brain abscess encountered during mastoidectomy. In 1886 Gowers and Barker diagnosed, localized, trephined, drained, and cured the first case of brain abscess in which there was no external fistula leading to the cavity. In 1887 Caird and Greenfield treated a similar case with recovery and Schwartze successfully drained a cerebellar abscess for the first time. The next year Horsley drained a left temporosphenoidal abscess, basing diagnosis and localization on the history and neurological evidence. In 1890 Braun was able to collect 11 successful operative results. Macewen's record of 15 cases with 14 recoveries, published in 1893, established firmly the necessity for surgical drainage in the treatment of abscess of the brain. In his introduction to his monograph on "Pyogenic Diseases of the Brain and Spinal Cord," Macewen states "he now regards an uncomplicated cerebral abscess, early recognized, accurately localized, and promptly operated on, as one of the most satisfactory of intracranial lesions, the patient at once being relieved from a perilous condition and usually restored to sound health."

ETIOLOGY

Before going further it seems wise to describe exactly the lesion under discussion. This review is concerned solely with subcortical abscess of the brain, acute or chronic, with or without a capsule. Extradural, subdural, or intrapia-arachnoid collections of pus are not under consideration. For the present purpose, when the term brain abscess is used, reference is made only to the subcortical abscess.

The frequency with which brain abscess occurs varies with the material used in computation of the figures. In a seven-year period, Dench reports that 94,469 cases passed through the New York Eye and Ear Infirmary and that clinically a brain abscess was discovered in 11 patients. In 1934 Courville and Nielsen reviewed the literature on the statistics from continental European clinics where an autopsy was performed in every case. In 147,604 autopsies, 277 instances of brain abscess were found, or .19 per cent. Among 45,272 autopsies on cases with otitis media, acute or chronic, 68 (.15 per cent) revealed a brain abscess. However, Evans, reporting on 10,280 autopsies from the London Hospital, records 718 cases with otitis media, and in 74, or 10.3 per cent, a brain abscess was found. The contrast between these figures may be due to the fact that in the continental European clinics, an autopsy was done in every case, whereas in the London hospital, no indication exists that this was done in all instances.

It seems evident, however, that chronic infection of the middle ear and mastoid is the principal cause for brain abscess. Gowers, reviewing a series of 241 such lesions found 102 (42.4 per cent) due to infection in or about the internal ear.

Courville and Nielsen report 1,225 cases of brain abscess following otitis media. Eighty per cent were a sequel to chronic otitis, but 20 per cent followed acute otitis. In a compilation of the relative frequency of the various intracranial complications of otitis among 1,379 autopsied cases, it was found that 51 per cent were accompanied by an extradural abscess, 23 per cent by sinus phlebitis, 17 per cent by leptomeningitis, 8 per cent by brain abscess, and 1 per cent by subdural abscess. This figure for the frequency of brain abscess corresponds roughly with that of Evans. A mass of statistics is included in this report. Two-thirds of all brain abscesses are found in the cerebral hemispheres. Whether the abscess be cerebral or cerebellar, the right or left hemisphere is involved with equal frequency. Males are more subject to abscess than females. When a brain abscess occurs as a result of infection in the cranial sinuses, in 90 per cent of the cases the abscess is solitary, in 10 per cent multiple. Intracranial complications seem to be more frequent when the otitis is on the right side (in 58.5 per cent) than on the left (in 41.5 per cent). No difference in the age incidence occurs between cerebral and cerebellar abscess. Twelve per cent of brain abscesses appear in the first decade, 57 per cent in the second and third, 15 per cent in the fourth, and 16 per cent in patients past fifty years. Holt has reported 27 collected cases of brain abscess in infants. Sanford reviewed the literature in 1928, adding 2 cases of his own. Otitis and trauma were the most frequent causes for abscess formation. In 14 cases the abscess was cerebral, and in 4 cerebellar. Six of the 14 cerebral abscesses were multiple. Of the single cerebral lesions 5 were frontal, 2 temporal, and 1 was parietal. Staphylococci were present in 9 of the 10 cases cultured. All of the infants died.

Infection can reach the brain in one of four ways: (1) by direct implantation from a penetrating wound due either to violence or following surgical intervention; (2) by contiguous extension from an adjacent source of infection along the blood vessels or Virchow-Robin spaces, or through preformed paths, nerve sheaths, or foramina; (3) by metastatic extension from a non-adjacent source through the blood stream; and (4) by undetermined pathways from unknown sources of infection.

The results of the last war seem to show clearly that a brain abscess rarely follows head injury unless the dura is penetrated. Holmes, after review of a series of 2,357 cases of post-war head injuries, among which 37 abscesses (1.4 per cent) were found, states that post-traumatic abscess was never encountered unless the dura had been opened. Tuffier and Guillain confirm this opinion. Examination of the records of 5,664 post-war head injuries showed 94, or 1.4 per cent, with brain abscess. Steinthal found that 39 cases (13.7 per cent) of brain abscess occurred among 234 cases of open head wounds. Penetrating wounds or chronic osteomyelitis resulting from cranial trauma was the causative factor in every case in which an abscess occurred. All observers of postwar head wounds state that a persistent fistula due to a chronic osteomyelitis of the skull should always be cleaned out lest an intracranial abscess result from chronic infection. Foreign bodies, especially if metallic, are well tolerated in the brain. Indriven spicules of bone and nonmetallic foreign bodies are much more likely to result eventually in abscess formation.

A brain abscess forms relatively rapidly after a penetrating injury. Tuffier and Guillain, in a study of 73 cases of post-traumatic abscess found that 34 appeared within three months of injury, 15 within a year of injury, and 16 after more than a year following injury. Among Holmes' series of 37 secondary abscesses, 23 appeared within from three to six months after the wound, 4 between six and seven months, 3 between the eighth and ninth months. In Alajouanine, Maissonnett and Petit-Dutaillis' series of 93 post-traumatic abscesses, 86 were solitary, 7 multiple. Patients with penetrating wounds and included foreign bodies, whether indriven spicules of bone, a bullet, or shell or bomb fragment, may develop an abscess about the source as late as twenty years after the original injury.

Evans, in his series of 194 cases of brain abscess, encountered 8, or 4. 1 per cent, following a penetrating wound of the brain. No example of brain abscess was found at autopsy in 318 cases in which death followed bruising, hemorrhage, or laceration of the brain without penetration of the skull. Acute osteomyelitis of the skull was found at necropsy in 51 cases, but in no single instance could an abscess of the brain be demonstrated.

A brain abscess can be produced by surgical implantation of infection if the surgeon is unwise enough to plunge into the brain through an infected area in an attempt to locate and drain an abscess. How frequently this occurs it is impossible to say for reports of such cases are recorded but rarely. That it can happen is attested by the case described by Courville and Nielsen. A heavily encapsulated abscess of the left temporal lobe was exposed at autopsy. The numerous hemorrhagic puncture marks left by repeated and unsuccessful attempts at striking the abscess were

found in the centrum of the temporal lobe. Along the tracks made by the needle were found many pneumococci, the organism which was also found in the mastoid and middle ear. Numerous foci disclosed the characteristic findings of early abscess formation. Hamperl reports 3 similar cases.

Brain abscess develops most frequently by spread of infection from a contiguous focus. Middle-ear infection is the principal factor in its production, although the paranasal sinuses are not infrequently the primary focus. In Evans' series of 194 cases of brain abscess, 123 (63 per cent) were the result of contiguous infection—in 109 cases (56 per cent) from the mastoid, in 12 (17 per cent) from the paranasal sinuses, and in 2 (1 per cent) from malignant invasion of the skull. In Eagleton's analysis of 140 frontal-lobe abscesses, 104 were due to contiguous sinus infection (75 per cent frontal, 25 per cent ethmoid or sphenoid.) Eggston, in analyzing the pathways of infection in 67 cases of brain abscess, found the auditory apparatus was involved in 37 and the paranasal sinuses in 18; osteomyelitis was present in 3, and miscellaneous conditions were found in 9. In 1930 Skillern and Coates reported 27 cases of abscess in the frontal lobe due to frontal-sinus infection.

Given middle-ear infection, in what part of the mastoid does the osteomyelitis most frequently penetrate to the dura? Does spread of infection to any particular area of the mastoid produce an abscess in any definite region of the brain? A combined report of the series of cases described by Blau, Nuehsmann, Dench, Evans, and Courville and Nielsen shows 366 cases in which the spread of infection in the mastoid could be determined with accuracy. In 237, or 64 per cent the tegmen tympani or antri showed necrosis or perforation in this area with involvement of the adjacent dura. The temporosphenoidal lobe is the site of the abscess in the great majority of such cases, in 23 of 28 instances in Evans' series. Koerner, in 1895, stated a "law" that in the great majority of cases of otitic abscess of the brain, the abscess would be found in the immediate neighborhood of the petrous bone in the temporal lobe or cerebellum. While this rule still holds good in the majority of cases, Nielsen and Courville, after a careful search of the literature, were able to find 34 cases of frontal-lobe and 27 instances of parietal-lobe abscess following otogenous infection. Evans reports 6 abscesses in a series of 62 following otitic infection, which were situated in the occipital, parietal, or frontal lobes.

If, therefore, the tegmen tympani or antri, or the zygomatic cells of the mastoid are the focus of infection, the temporosphenoidal lobe is the common situation in which the abscess makes its appearance.

Eagleton studied the routes by which infection passed from the mastoid to the cerebellum in 125 reported cases. In 42 (33 per cent) the labyrinth and adjacent structures were involved, in another 42 (33 per cent) the lateral sinus was thrombosed, in 22 (18 per cent) the petrous bone was carious, and in 9 (7 per cent) the infection had passed through the internal auditory canal. Okada reviewed 109 cases of cerebellar abscess. Fifty-two (47 per cent) showed labyrinthitis, 43 (39 per cent) sinus thrombosis or perisinusitis. In 28 of Evans' series of 37 cases in which purulent thrombosis of the lateral sinus was disclosed, the abscess was found in the cerebellum. According to Eagleton's figures, when an abscess forms in the cerebellum, the anterior part of the hemisphere is somewhat more frequently involved (30 cases) than the posterior two-thirds (23 cases). The whole of the lateral hemisphere may be occupied by the abscess cavity (11 cases). Of the 125 instances of cerebellar abscess which he studied 10 were multiple and 2 bilateral.

Purulent sinus thrombosis, a similar involvement of the labyrinth, or osteomyelitis of the cells in Trautman's triangle suggests a cerebellar abscess.

The method by which infection passes into the brain from an adjacent focus of osteomyelitis in the wall of an infected sinus has long been a matter of controversy. Certain it is that if the organisms involved are virulent when the dura and arachnoid are reached and penetrated, meningitis will develop before an abscess forms unless the sub-arachnoid space is in some fashion obliterated. Once the dura is reached, three routes for the passage of infection into the brain have been described; along the perivascular spaces or by retrograde thrombosis of the adjacent veins or arteries. Macewen stated that infection could pass inward by retrograde thrombosis of the neighboring veins. Eagleton vigorously supports this view, although he as well as Macewen agrees that the perivascular spaces might well be the channels through which organisms gain access to the brain. Wittmaak pointed out the presence of many small veins passing through the tegmen. He was of the opinion that retrograde phlebitis in these veins might produce an abscess. Heine and Beck agree with Wittmaak. Atkinson is strongly convinced that the perivascular route is the most common. In 13 of the 16 cases which he studied he believed that the abscess had been produced by this means. Piquet is of this same opinion.

The means by which infection reaches the brain is of more than simple pathological importance. If the infection has passed across the subarachnoid space as a consequence of the formation of adhesions between the dura, arachnoid, and pia, the subarachnoid space has been blocked off at that point. Hence, the establishment of drainage through this area will greatly reduce the possibility of meningitis. This is the abscess "with stalk" referred to by Koerner, who stated that 42 per cent of all contiguous abscesses had a "stalk."

When the otologist suspected the presence of an abscess following mastoid infection, the dura was exposed and examined for granulations or other evidence of infection. In this area the dura was opened or needled with the hope that in this way drainage could be established without the production of meningitis.

The frequency with which "stalk" formation occurs following contiguous abscess has been questioned. Eagleton states that in the records of 131 cases of brain abscess that he analyzed, a sinus leading to the abscess was found in but 4. In a series of 75 instances of brains containing an abscess studied by Carmichael, Kernohan, and Adson, such a "stalk" was not encountered either macroscopically or microscopically in any instance. However, in many instances the dura was not available for study and in others, the "stalk" may have been obliterated by the process itself or by the subsequent operative procedure.

Beck reports 3 cases and Drummond a single instance of spontaneous rupture of a temporal-lobe abscess through to the external surface of the brain. That this rupture occurred along the pathways involved in formation of the abscess seems highly probable.

Retrograde venous thrombosis is certainly the cause of many a cerebellar abscess when the lateral sinus is involved. Bagley has shown that the superior petrosal sinus receives veins from both the tympanic cavity through adjacent dural veins and the cortex of the temporal lobe. A vascular connection is thereby established by which infection can be transmitted from one to the other area with abscess formation at a distance from the original focus. Courville and Nielsen believe this is the way by which infection spreads from the ear to the frontal or parietal lobes. Furstenberg, and Turner and Reynolds believe that many a frontal lobe abscess is thus produced. The infection passes in through the mucous membrane lining the frontal sinus and involves the bone. From the diploë, venous channels extend backward finally reaching the internal table and joining with veins which pierce the dura and join the cortical vessels. Once the dural veins are involved, infectious granulations appear which cut off the blood supply to the adjacent bone and spread the osteomyelitis. At some point infection may pass through the dura, form adhesions across the subarachnoid space, and produce a focus through which a subcortical abscess may be formed.

As Carmichael, Kernohan, and Adson point out, perivascular infiltration is present about every abscess. A metastatic abscess forming in the temporal lobe near the cortex, and the accompanying perivascular infiltration reaching out toward the cortex without any evidence of mastoid or middle-ear infection could easily simulate stalk formation. Atkinson states that in all cases of adjacent brain abscess there is a point of entry to be found on the dura. In 43 of Evans' 74 cases of abscess complicating otitis media, in which there was focal infection of the dura and subjacent leptomeninges which bound the meninges to the surface of the cerebrum or cerebellum, the abscess beneath was separated from the meninges by a zone of macroscopically unaltered cortex and meninges. The probable method of spread in these cases was extension of the inflammation from the subarachnoid space along the perivascular spaces of perforating vessels. Unfortunately, no microscopic examination was made of the intervening tissue.

That a combination of these routes may be the means of the passage of infection into the brain seems probable. In the cases reported by Neff and Schnierer, one or both of two possible pathways were involved. Infection may extend to the dura by way of the veins from the mucous membrane of the tympanum or antrum, and set up a focal pachymeningitis from which the cortical vessels are affected by contiguity. Or, a large cortical vein may pass through a focal infection in the leptomeninges over the tegmen. Thrombosis of the vein may be responsible for abscess some distance forward in the lobe, well away from the original focus.

The passage of infection through preformed paths, nerve sheaths, or foramina is not uncommon. In 55 (44 per cent) of the 125 cerebellar abscesses studied by Eagleton the infection reached the cerebellum—through the labyrinth in 19; through the vestibular aqueduct in 17; through the internal auditory meatus in 8, through the semi-circular canals in 6, and through the subacute hiatus in 5. In 1 of Evans' 40 cases of cerebellar abscess, the infection reached the cerebellum through the internal auditory meatus.

A brain abscess is frequently the result of infection carried through the blood stream. In 46 (23.7 per cent) of 194 cases described by Evans the abscess was formed in this way. In 22 cases the original focus of infection was intrathoracic; in 24, extrathoracic. In 17 of 22 cases due to intrapulmonary suppuration the pulmonary pathology was chronic bronchiectasis; in 5, empyema.

Charrier and Ferradou have recently reviewed the literature on metastatic brain abscess consequent upon intrapulmonary infection. Among a series of 280 cases the brain abscess followed chronic bronchiectasis in 133 cases; empyema in 55; and lung abscess in 30. In 79 of 145 cases the brain abscess was solitary; in 66, multiple. Fifty-nine patients had an abscess in the cerebral hemispheres, 5 in the cerebellum. Seventy per cent of the cases were males, 30 per cent females. Nickerson, basing his figures on 538 cases of septic pleuropulmonary disease, found that 74 cases of lung abscess presented 11 instances of brain abscess (14.7 per cent); 66 cases of empyema presented a single abscess (1.5 per cent), and 41 cases of bronchiectasis presented no cerebral metastasis. In 8 cases the brain abscess was single, in 4 multiple. Cohen, in reporting on 19 cases of brain abscess accompanying putrid pleuropulmonary suppuration, found that 14 occurred with lung abscess, 4 with empyema, and 1 with bronchiectasis. Ten of the brain lesions were solitary; 4 were multiple abscesses. Of Parker's 14 cases, 7 were single abscesses, and 7 multiple. Apparently no matter what the type of septic pulmonary lesion, brain abscess is always to be feared. In Schorstein's 19 cases, death occurred in from three to twenty-eight days, an average of ten days following the onset of symptoms. In Evans' series, 14 of 17 patients died within three weeks of the onset of symptoms, 9 within fourteen days. In almost one-third of this group, more than one abscess was found at autopsy. Curiously enough, acute bronchiectasis and lung abscess were infrequently the cause for brain abscess in Schorstein's report.

Brain abscess resulting from extrathoracic suppuration can result from a local focus of infection in any region of the body. Twenty-four of the 194 cases in Evans' series resulted from extrathoracic suppuration. Krause states that a brain abscess is not a frequent sequel of systemic pyemia. According to Sperling, endocarditis rarely results in brain abscess. However, Goldman and Shwartzman report 14 cases of abscess of the brain found at autopsy among 168 cases of streptococcus-hemolyticus bacteriemia. Osteomyelitis seems to be the predominant cause for such an abscess. Again many of these lesions in the brain are multiple.

Gowers states that following pulmonary disease, the left cerebral hemisphere is more usually involved than the right, and that the abscess is apt to develop in the frontal lobes. Evans, Groth, and Schorstein did not believe that any marked difference existed between the frequencies of involvement of the right and left hemispheres. All these authors state that in metastatic abscess, whether from intrapulmonary or extrapulmonary infection, the cerebral hemispheres are the usual site of abscess formation, the cerebellum but rarely.

King comments upon the high mortality in acute metastatic abscess of the brain. He reports a series of 6 cases of metastatic cerebral abscess, 4 acute and 2 chronic. One of the acute cases ended in recovery. King refers to but 2 other cases of acute metastatic abscess in which the patient survived (Cairns and Donald, and Roulland). King believes that the high mortality is due to early rupture into the ventricle and intracranial pressure from brain edema. Early recognition and operation within six or seven days of the onset of symptoms is essential for recovery.

A brain abscess can form by unknown pathways from an undiscovered source of infection. Yaskin, Grant, and Groff report 4 such cases. Faunce and Shambaugh describe a case of brain abscess due apparently to mastoid disease, although the drum membrane was normal. A very careful search must always be made for the primary source of infection before the formation of a brain abscess is stated to result from a septic focus of unknown etiology. If the search is sufficiently detailed, the focus will always be found.

THE HISTOPATHOLOGY OF BRAIN ABSCESS

Once infection has gained an entrance into the brain structures, whether along perivascular spaces, by retrograde thrombosis, or as a septic embolus in the blood stream from an extracranial source, the development of the abscess within the brain follows much the same course. The rapidity of its spread depends upon the virulence of the organisms involved and the resistance of the host. Globus and Horn state: "The earliest appearance of an abscess of the brain is that of a small circumscribed area crowded with bacteria, numerous polymorphonuclear leucocytes, lymphocytes, red blood cells, and disintegrating nerve elements." Carmichael, Kernohan, and Adson write, "It is apparent from the onset that an abscess does not have its origin 'de novo' in the tissues of the

brain, but rather arises slowly from a microscopic focus and progresses usually regularly, although occasionally irregularly, to a stage of development in which owing to a certain degree of delimitation, it deserves the distinction of the term abscess in its common sense."

Atkinson states that a brain abscess forms just below the cortex in the flat sheet of white matter which is a relatively avascular zone. The blood vessels entering from the cortex and the central branches which pass directly upward from the base of the brain and supply the central nuclei and the main mass of the white matter are end arteries. Orr sustains this opinion, but the researches of Pfeifer, Cobb, and Lorente de No indicate that a capillary network connecting cortical and central vessels can be identified throughout this avascular zone. However, while this zone may not be entirely avascular, it seems to have a less efficient blood supply than either the cortex or the deeper layers of the white matter. It is in this area that an abscess is very frequently found. Atkinson is of the opinion that the spread of an abscess is explained by the presence of this avascular zone. The cortex is protected by its good blood supply. Extension of the abscess is to a certain extent in all directions, but it tends to burrow inward along the vessels toward the lateral ventricle. Hoffman believes from a careful autopsy study of the brain in 12 cases of temporal-lobe abscess that an abscess on the surface may progress in a different manner than a similar deep-seated lesion. This difference in reaction depends upon a dissimilarity in the blood supply of the two regions. The cortex has a free blood supply from the cortical vessels, whereas the white matter is less well supplied and the arteries are all terminal vessels. In a deep-seated abscess, the tendency is always to extend inward toward the inferior horn of the lateral ventricle. In 6 of this author's 12 cases, rupture into the ventricle had occurred. A cortical abscess much less frequently breaks into the cortical subarachnoid space because extension in this direction is checked by the excellent blood supply. However, 2 of these 12 cases showed encapsulation. In the cerebellum an abscess develops in one lobule, extends backward in it, pushes adjacent lobules aside, and involves them secondarily only.

Carmichael, Kernohan, and Adson have outlined the following stages in the development of an abscess for the purpose of description:

1. Focal necrosis; microgliosis
2. Primary delimitation; fibrosis
3. Secondary delimitation; astrogliosis
4. Repair; vascularization

In the first stage the outstanding feature of these lesions is the central necrotic core composed of polymorphonuclear cells, lymphocytes, monocytes, and gitter cells. The blood vessels show hyperemia, perivascular infiltration, occlusive endarteritis, endophlebitis, and hemorrhage. Microglia cells are especially numerous and are the earliest participants among the cerebral elements of the inflammatory reaction. Globus and Horn comment that at this stage a number of adjacent vessels may show evidence of involvement, and, as the necrosis from interference with the vascular supply spreads, these separate areas coalesce to form the body of the abscess. In this stage the abscess consists of two layers, the central necrotic core which is surrounded by a vague ill-defined region of hyperemia and microgliosis.

In the second stage the necrotic center of the abscess is still present although evidence of acute infection is less marked. The microglia have assumed rod or irregularly shaped forms. Astrocytes appear in greater numbers at a distance from the central zone of necrosis. The principal change in this stage is the appearance of fibroblasts, especially in the zone of hyperemia lying adjacent to the necrotic border. Carmichael, Kernohan and Adson, Diamond and Bassoe, and Freeman believe that these fibroblasts arise from the proliferating blood vessels. Hassin, and Globus and Horn believe that they are derived from lymphocytes which have migrated into the area of infection. In this stage the abscess is formed by three layers merging one into another —the central area of liquefaction necrosis, an adjacent region of hyperemia and fibroblastic proliferation, and the external poorly defined layer of early astrogliosis.

In the third phase a definite proliferation of blood vessels is noted. These new blood vessels have no perivascular spaces, which suggests that they are newly formed. There is an increase in the number of microglia, astroglia, and fibroblasts. The fibrous zone about the abscess is greater in extent and more compact. Finally, in the fourth stage, a definite delimitation of the size of the abscess occurs. Four layers may be identified— a central necrotic zone, with its revascularizing granulomatous border, a zone of hyperemia and fibrosis, and lastly an external zone of gliosis. Homén and Alpers have described the histopathology of abscess formation in practically the same stages as here outlined. However, Homén notes as his fourth layer, a rarefied area composed of edematous brain tissue, encircling the abscess. Alpers speaks of an encephalitic zone surrounding it. From the clinical standpoint these slightly dif-

fering descriptions are of importance. The zone of edema may account for symptoms of pressure otherwise inexplicable when the abscess is small. The outlying area of encephalitis shows that even an encapsulated abscess may not be quiescent.

The time of formation of the abscess capsule seems to depend upon two factors, the virulence of the organisms involved and the resistance of the host. A study of the reports of Homén, Westphal, Merkens, Lebert, and Uchermann, Schatt, and Jansen shows that a capsule may never form about an abscess, may be very slow in its development, or may be definitely present by the end of the second week. In Alpers' series, when encapsulation took place, the process was well defined by the end of the third week after the onset of symptoms. One abscess, however, had no capsule at the end of eleven months. All of Schorstein's 19 cases of metastatic abscess showed a capsule after seventeen days; Krause's, and Saelhof's after the twenty-fourth day. If delimitation by encapsulation occurs, the process is well defined by the end of the third week. An abscess as it becomes older does not, therefore, become more heavily encapsulated. A relatively acute abscess may have a thick wall.

Any of the infectious bacteria can produce a brain abscess. Those organisms most commonly found in the sinuses, streptococci or pneumococci, are most frequently recovered from a contiguous brain abscess resulting from infection in those areas (Doelger, Forselles, Hasslauer). However, staphylococci will be found in many post-traumatic or metastatic abscesses (Coleman, Alpers).

The type of organism involved seems to have a bearing on the speed and degree of encapsulation. Brunner states that destructive and necrotic changes are increased by the gram-negative anaerobic bacteria, but aerobic organisms influence the reparative process and, hence, capsule formation. Neumann writes that the anaerobic bacteria prevent the development of a capsule, while the cocci, especially the capsular cocci, produce a layer of fibrin soon after penetration into the substance of the brain and, hence, lead to the formation of a capsule. It is agreed that anaerobic bacteria do not favor the formation of a capsule, while aerobic organisms, especially the cocci, tend to aid encapsulation. It must always be remembered that an encapsulated abscess is not by any means a quiescent abscess. Within the cavity of the abscess may be virulent bacteria which if permitted to escape into the meninges may produce fatal meningitis. Practically all abscesses contain bacteria. Only occasionally is a sterile abscess encountered.

The pathological development of a brain abscess has been detailed because of the importance of delimitation and capsule formation in determining the proper time for surgical drainage. Definite rules apply to the drainage of infectious processes elsewhere in the body. No surgeon opens a furuncle until it is localized. The same principles should apply to a brain abscess. The best surgical results have followed operation after encapsulation or, at least, limitation of spread of the abscess has occurred. Nice surgical judgment and much experience are required to reach the decision whether or not a brain abscess has become localized. Operate too early and but little is found save spreading encephalitis. Wait too long and the abscess may rupture into the ventricle or the patient may be carried off by a sudden and unexpected rise of intracranial pressure.

SYMPTOMS OF BRAIN ABSCESS

The symptoms of brain abscess can develop in many ways. The sudden abrupt appearance of clinical evidence of an intracranial lesion suggests cerebral hemorrhage. However, a hematogenous abscess may produce a clinical picture of this variety. Conchon and Alajouanine and Petit-Dutaillis report that a patient who has had a penetrating brain wound and apparently been in perfect health for a number of years may suddenly develop an intense headache, become rapidly stuporous, and die within twenty-four hours from rupture of a latent abscess into the ventricle and from fulminating meningitis. Or, the headache may appear more slowly; the patient sinks into a stupor gradually, the neck is stiff, and organisms are found in the spinal fluid, all being due to a slowly leaking abscess. In this group the meningitic signs predominate. Occasionally, a convulsive attack may be the first evidence of the presence of a brain abscess.

As a rule the symptoms of a brain abscess develop slowly, in a fashion similar to those due to any intracranial mass lesion, whether that lesion be tumor, abscess, or chronic subdural hemorrhage. In any clinic passing upon a large neurological material, errors in differential diagnosis between these three intracranial mass lesions are not infrequent. This may seem strange to the otologist, whose problem has been in the past not so much one of differential diagnosis, but of determining whether an abscess was present, and, if so, what its situation. However, from the very nature of the otological material, the decision is simplified, because an antecedent history of mastoid or paranasal sinus infection is present. The neurologist and neurosurgeon have come to learn

that the determining factor in reaching a presumptive diagnosis of brain abscess is a history of infection preceding the onset of symptoms. This infection may be of any variety in any area. Sinus disease, cranial trauma, and intrathoracic suppuration are well recognized foci, but until the realization is driven home that any infection may be a potential cause for brain abscess this differential diagnosis will be missed with consequent disastrous results. A history of previous infection is often hard to obtain. The infection may have been trivial and in the distant past, overlooked even after careful questioning. Or, the patient's mental condition may be such that reliable answers are not forthcoming, and the history from friends or relatives incomplete through ignorance. Any evidence of infection in the patient's history should cause grave suspicion that a brain abscess is present. Surgical attack on the lesion should under these circumstances be based on the presumption that the lesion is an abscess until clear proof to the contrary exists.

In addition to an antecedent history of infection, headache and retardation of mental processes are important indications that an abscess is present. Tumor or chronic subdural hemorrhage can produce these symptoms, but they are particularly striking with abscess. Headache is an early complaint and may become intense, not infrequently tending to localize either on the side of or directly over the abscess. A patient with an abscess seems on the whole to be less alert than his general condition warrants. As Kennedy puts it—a brain abscess produces a "muddied intellect" to a more obvious degree than does a tumor.

Nausea and vomiting, projectile in type, are frequently seen with abscess, although not more so than with hemorrhage or tumor. Constipation is common. A temperature that tends to be subnormal has long been recorded as characteristic of abscess. This is true, although a metastatic abscess may, at the development of symptoms, produce a mild pyrexia. Retardation of pulse and respiration are certainly more common when an abscess is present than when a brain tumor is found. Macewen and Okada have called attention to the emaciation which may accompany an abscess of the cerebellum.

Eagleton and others have claimed that papilledema is an uncommon result of abscess. Eagleton's material was made up for the most part of cases of contiguous abscess from sinus disease in which immediate surgery prior to encapsulation was urged. However, White, in studying 184 cases of intracranial complications of otitic origin, found papilledema in 68 per cent of the cases of temporosphenoidal abscess and in 38 per cent of those of cerebellar abscess. Blau reports choking in 54 per cent of 153 cases of cerebral abscess, and in 34 per cent of 57 cases of other cerebellar lesions. Parker found choked disc in 14 (56 per cent) of 25 cases of brain abscess; Benedict and Lillie in 8 of 11 cases of abscess of the frontal lobe. Choked disc was recorded in 20 of 30 cases in Grant's series in which encapsulation of the abscess had occurred. Cowan found frank choking of the disc in 28 (63.6 per cent) of 44 verified cases of abscess. In this group 42.8 per cent of the cases of cerebellar abscess had definite papilledema up to 5 diopters. Coleman states that evidence of intracranial pressure on fundiscopic examination may be found in patients with abscess with the same frequency as in patients with brain tumor. Obviously, certain abscesses, like certain tumors, may advance rapidly and destroy brain tissue without increasing the intracranial pressure. An encapsulated abscess seems to produce papilledema in most cases. Curiously enough a cerebellar abscess is generally reported less likely to cause choked disc than a tumor in a similar location, although Atkinson denies this. Like a tumor, the abscess may or may not be situated ipsilateral to the fundus showing the larger swelling.

As a rule the leucocyte count in the blood is no more than suggestive when a brain abscess is present. Unfortunately, this is true particularly when a sinus or intrathoracic infection already exists, which can of itself account for the increase in leucocytosis.

Lumbar puncture may give important information with respect to the intracranial pressure, the presence or absence of pleocytosis in the spinal fluid, and the amount of albuminosis. If the initial pressure is high, withdrawal of fluid should be done with extreme caution. A fluid which is almost always sterile and shows a relatively low cell count suggests abscess. Yerger states that the cell count is usually below 500 per cu. mm. He found that any cell count over 10,000 per cu. mm. was always accompanied by a septic meningitis. The higher the cell count was, the more active the infectious process. An encapsulated, subsiding infection may show very few cells, all lymphocytes. Andre-Thomas, Borries, and Lecene, Mestrezat, and Bouttier have called attention to the fact that a low cell count and a high albumen content in the fluid is suggestive of a walled-off abscess. Woltman, Van Caneghem and Leroy, Dixon, and Karbowski have noted that a relatively small number of cells, especially when these cells are lymphocytes, point to abscess formation.

The clinical findings described—a history of infection, followed by headache, mental dullness, vomiting, slow pulse and respirations, papilledema, and increased tension on lumbar puncture—are evidence of intracranial pressure suggesting the presence of an intracranial mass lesion presumably abscess, but are in no way indicative of its position within the brain.

While it does not fall within the province of this review to discuss in detail the neurological evidence upon which the localization of abscess is based, the following facts seem important. The position of the primary focus of infection is of value in localization. As has been noted, an abscess consequent upon mastoid disease is most frequently found in the adjacent temporosphenoidal lobe (66 per cent), and next most frequently in the ipsilateral cerebellar lobe (33 per cent). Paranasal sinus infection is followed, as a rule, by an abscess which forms in the adjacent frontal lobe.

The reviewer believes that if the patient's condition permits, the primary focus of a suspected adjacent abscess should always be eradicated before the abscess is drained; first, because the operation may show the area in which the infection has passed through the bone to the dura and thus help in suggesting the position of the abscess, and, second, because unless the primary focus has been eliminated, reinfection of the abscess cavity may occur and nullify an apparently successful drainage of the cavity. Tylor states that in 29 of 47 cases of brain abscess following mastoid disease, the abscess was in the temporosphenoidal lobe, and in 12, in the cerebellum. In 12 of those in which the abscess was located in the temporal lobe the infection occurred through the tegmen tympani, and in 5 through the posterior tympanic wall, mastoid cells, or antrum. Among the 12 cerebellar abscesses, the infection spread through the posterior tympanic wall, mastoid cells, or antrum in 4, from the lateral sinus in 3, and from the labyrinth in 4. Involvement of the tegmen then implies a temporosphenoidal abscess, while involvement of the lateral sinus or labyrinth suggests a cerebellar abscess.

The history of the exact nature of a previous head injury and the presence of a scar on the scalp may be important clues as to the position of a post-traumatic abscess. All authors agree that an abscess due to a penetrating wound always forms along the tract produced by the injury. Since acute trauma of this type involving the cerebellum is usually fatal, a post-traumatic cerebellar abscess is uncommon.

Statistics seem to show that a hematogenous abscess tends to form in the fore part of either cerebral hemisphere and that the left side is possibly more frequently involved than the right. The cerebellum is very infrequently the site of a hematogenous abscess.

Since mastoid disease is the most common cause for brain abscess and since the larger number of these lesions are found in the adjacent temporal lobe, a brief review of Macewen's findings in these cases is pertinent. Otorrhea, occasionally acute but predominantly chronic, is present. The discharge increases following exposure or a cold, then ceases, and pain develops in the ear. After from twenty-four to forty-eight hours of severe local distress with loss of appetite and vomiting, the pain subsides. A chill varying in degree from a mere feeling of cold to a violent paroxysm occurs. In a day or two all these symptoms may disappear, although a mild intermittent dull headache remains. Gradually the headache increases, cerebration becomes slowly dulled, and there is a marked want of sustained attention. Percussion over the temporal bone above the mastoid may be painful. A weakness of the opposite side of the face of the central type is often the first neurological sign of any value. Lebert is the only author to stress the presence of a convulsive attack as an early manifestation of abscess. Gradually the muscular power of the opposite arm may become involved. A contralateral Babinski reflex may be noted. A temporal-lobe abscess on either side can produce a defect in the visual fields, usually a contralateral homonymous hemianopsia, partial or complete. However, the patient may be so inattentive or stuporous that visual field tests are unreliable. In his series of 28 patients with abscess, Coleman could apply these tests in but 9. Cowan found visual defects of this character in 3 of 9 verified cases of abscess in the temporal lobe and in 2 of 4 cases of abscess in the occipital lobe. The reviewer can only urge that visual-field studies be made promptly in every patient suspected of harboring an abscess. If made before the patient's coöperation is lost, they should be of the same value in localizing an abscess as they are when a tumor is present. An abscess of the left temporal lobe in a right-handed individual causes speech difficulties, usually in the nature of an inability correctly to name objects or to use words in their proper meaning.

A frontal-lobe abscess may be difficult to localize. Previous infection in the paranasal sinuses is always suggestive of an adjacent abscess. Cowan, in a study of 17 cases of abscess of the

frontal-lobe, noted 5 with exophthalmos, swelling of the eyelids, chemosis of the conjunctiva, and pain in or about the eye. Seven cases showed orbital involvement without exophthalmos. All these findings appeared in the eye ipsilateral to the abscess. Personality changes, witzelsucht, headache referred to the frontal area, a tendency to yawn, and, if the abscess is left-sided, a speech defect of the motor variety may be seen. Again the central type of contralateral facial paralysis may appear early and be followed by weakness of the contralateral extremities and a Babinski sign. Connor has reviewed the ocular manifestations accompanying frontal-lobe abscess. Among 202 cases, involvement of the oculomotor nerve in 22 instances and of the abducens nerve in 11 instances was recorded. Pupillary changes were noted in 43 patients. Among 202 cases 80 revealed fundus changes; 5 showed atrophy; and 75 gave evidence of pressure from congestion to true choking. Cowan records a frank choking of the disc in 11 of his 17 patients.

Atkinson states that in cerebellar abscess "cerebellar nystagmus is slow, coarse and horizontal, in contrast to the rapid-fire rotary nystagmus of labyrinthine disease, and is characteristically to the side of the lesion, though it may be accompanied by a quick, irregular nystagmus to the opposite side which may cause confusion; falling is to the affected side; pointing error is always outward and with the homolateral arm only; ataxia and dysdiadokokinesia are usually present to some degree, especially the former. A dead labyrinth to the Barany test plus nystagmus toward the side of the lesion is always very suggestive of a cerebellar abscess."

Roentgen-ray studies may be of value. The focus of infection and its extent may be shown, a foreign body revealed, and occasionally, as reported by Bagley, gas may form in an abscess and reveal its position. The position of the pineal gland, if it can be visualized, may give very vital information (Naffziger).

While the reports in the literature on the use of air in the localization of brain abscess are infrequent (Martin, Aubry and Guillaume), no experienced neurosurgeon would have any hesitation in employing ventricular estimation, ventriculography, or encephalography for localization. The danger of rupture of a thin-walled abscess is always present following this procedure. However, no effective surgical measures are possible unless the abscess can be localized. Therefore, the information to be gained by air insufflation fully justifies the risk involved. Moniz reports that he has localized a brain abscess by cerebral angiography. The reviewer is not familiar with this technique, but believes that since an unlocalized and therefore undrained abscess always results in a fatality, any reasonably safe method which results in accurate determination of its position should be used without hesitation.

The surgery of brain abscess gives the reviewer little cause for enthusiasm. Of all the surgical lesions in the brain, an abscess is the most treacherous. The potential complications that can be foreseen in an attack upon such a lesion are manifold. Diagnosis and localization may be easy, the time for surgical intervention may have seemingly been properly chosen, and the maneuvers to evacuate the pus correctly planned and executed, but only too frequently the patient dies. And even if the patient is discharged as cured, careful follow-up examinations will show a high proportion of unfortunate sequelæ.

Brain abscess until recently was considered to fall for the most part into the domain of the otologist, since by far the greater number of these lesions were encountered as a complication of mastoid or paranasal sinus disease. Only in the last twenty years has the neurosurgeon had the opportunity to operate upon many of them. And the neurosurgeon, being well versed in the handling of intracranial problems, such as pressure and its relief, in the interpretation of clinical neurological signs, in localization by the use of air, and in the employment of surgical procedures found valuable in removing brain tumors, has lowered somewhat the surgical mortality of abscess. Furthermore, the otologists seem quite willing to turn over these difficult cases to the neurosurgeon. Consequently, while the literature on the surgery of brain abscess prior to 1925 is written almost entirely by otologists, since that time many reviews of large series of cases and new suggestions for attacking these lesions have originated in neurosurgical clinics.

The three great problems to be solved in an attack upon a brain abscess are where, when, and how to operate. In the reviewer's opinion, where to operate can easily be determined; how to operate is, of course, important; but the decision as to when to operate is vital, requires the nicest judgment and the greatest experience, and, in the last analysis, determines the result. In other words, any reasonable surgical procedure, if applied at the proper time, has a better chance of success than a very skillful maneuver undertaken at the wrong moment.

In 1893, Macewen published the first surgical results in a large series of cases of brain abscess. Of 13 cerebral abscesses (10 temporosphenoidal,

2 frontal, 1 parietal) 11 were operated upon with recovery in 10. Two patients, one with a frontal-lobe abscess, and the other with a temporal-lobe abscess, died without operation. The operative fatality followed evacuation of a temporal-lobe abscess "in extremis" from rupture of the abscess into the lateral ventricle. Eight cerebellar lesions were seen, 2 not under Macewen's care, and 2 were not attacked surgically. The 4 cases of cerebellar abscess which were drained all ended in recovery. One of these presented a multiple abscess, in the cerebellum and in the posterior portion of the adjacent temporal lobe. The record of 15 operations for abscess with 14 recoveries is so far superior to any made for the next thirty-five years that a short discussion of the reasons for Macewen's success seems pertinent.

Macewen furnishes complete details of his methods of handling 12 cases of abscess, 8 cerebral, 3 cerebellar, and a multiple abscess of the cerebrum and cerebellum. Six of the cerebral and all of the cerebellar followed mastoid disease. Two of the cerebral, frontal and parietal in position, followed trauma-fracture of the skull and infection.

The reviewer believes from careful study of the protocols on these cases, that the principal cause for the high percentage of recovery in this series is that operation was delayed, either as a result of Macewen's decision or by force of circumstance, until the abscess had become well encapsulated. On 2 occasions only was drainage instituted prior to two weeks from the onset of symptoms. Seven patients had early or well marked choked disc. Three were so stuporous when operated upon that no anesthesia was required. In every case the abscess was "ripe" when opened. Also, the original focus of infection was always eradicated before drainage was instituted. The mastoid was promptly and radically drained. However, after this had been accomplished and information derived therefrom as to the point at which infection had penetrated the bone, Macewen seemed in no hurry to drain the abscess itself. The extreme care with which neurological evidence and other data were recorded gives the impression that he believed that delay was justified, (1) to note the result of the radical mastoidectomy on the condition of the patient, and (2) to be sure that the localization was correct. Lastly, he drained for the most part by enlarging his incision into a relatively clean field, sterilized the dura with 20 per cent carbolic solution, opened the abscess cavity widely, and cleaned it out under direct inspection and by irrigation before drainage was introduced. The drain was of non-rigid material and was not disturbed following its accurate insertion.

With this record as an indication of what could be done by a properly timed and executed attack upon a brain abscess, especially since Macewen described all the technical maneuvers involved, the surgery of this lesion seemingly had been placed upon a firm basis. However, subsequent results show that his teachings were disregarded. Koerner in 1925 reports on the mortality rate in brain abscess from cases collected in the literature up to 1901. Two hundred and twelve cases of cerebral abscess are recorded with 50.5 per cent recovery, and 55 cases of cerebellar abscess with 52.8 per cent recovery. His combined statistics since 1901 show that 24 among 126 cases of cerebral abscess and 30 among 67 cases of cerebellar abscess were not found at operation. Of 102 patients with cerebral abscesses operated upon 42 (41 per cent) recovered and 60 (59 per cent) died. Thirty-seven cases of cerebellar abscess were explored with 7 (19 per cent) recoveries and 30 (81 per cent) deaths. Neumann in 1930, combining the results from 12 Austro-German otological clinics, published for the most part prior to 1920, gives the following figures; among 387 patients with abscess of the temporal lobe 237 (61 per cent) died and 150 (39 per cent) recovered following surgical intervention. Of a group of 124 patients with cerebellar abscess, 109 (88 per cent) died and 15 (12 per cent) recovered. Other statistics not included in Neumann's report are available. Richter and Brock analyzed 47 cases of otitic brain abscess treated in the Erlangen Clinic from 1911 to 1934. Among the 47 cases were 24 temporal-lobe lesions with 12 deaths (50 per cent), and 23 cerebellar abscesses with 19 (75 per cent) deaths. Beck and Pollach, reporting on 40 cases of cerebellar abscess encountered in the Vienna University Clinic from 1919 to 1927, stated that 37 were recognized and operated upon with 12 recoveries (32.5 per cent) and 25 deaths (67.5 per cent). Brunner and Dinolt present a series of 29 cases of otogenous abscess of the temporal lobe. Four were found at autopsy. Twenty-five were operated upon with 8 (32 per cent) recoveries and 17 (68 per cent) deaths. Hagerup in 1936, reviewing 12 cases of rhinogenic abscess seen at the Municipal Hospital in Copenhagen between 1906 and 1933, 10 single and 2 multiple, reports 11 deaths. In 1925 Hirzinga from Holland recorded 28 cases following otitis; 24 cerebral lesions with 9 recoveries and 4 cerebellar lesions with 1 recovery. Lund of Stockholm in 1927 reported 54 cases of abscess

with 10 recoveries. Meurman, reviewing the 56 cases of brain abscess seen at the Otolaryngologic Clinic of the University of Helsingfors from 1901 to 1932, found 31 cerebral and 24 cerebellar lesions with a 71 per cent mortality from the cerebral and a 70 per cent mortality from the cerebellar lesions. Fraser and Blomfield, in analyzing 17 consecutive cases of cerebral abscess which were consequent upon otitis media and operated upon at the Royal Infirmary in Edinburgh from 1908 to 1929, report 6 recoveries and 11 deaths. Balado and Franke in 1928 reported from Argentina 6 cases of abscess with 5 deaths. Dench in 1929, reviewing 27 cases which were seen personally and included 11 encountered in a seven-year period in the New York Eye and Ear Infirmary, reports 21 cerebral abscesses with 9 recoveries (40 per cent) and 12 deaths (60 per cent), and 6 cerebellar abscesses with 2 recoveries (33 per cent) and 4 deaths (66 per cent). In 1936, Piquet and Minne of France recorded 16 cerebral abscesses with 7 recoveries, and 6 cerebellar abscesses with 3 cures. These authors reviewed the cases of solitary encapsulated abscess reported in the literature from 1920 to 1929. Among 65 patients harboring a cerebral abscess, 57 recovered (87 per cent) and 8 died. Among 25 patients with a cerebellar abscess 17 recovered (68 per cent) and 8 died. These figures are much superior to those quoted by Neumann or collected by the reviewer which represent for the most part the period from 1900 to 1920. However, Piquet and Minne give no details as to the cause of the abscesses included in their report. The reviewer suspects that while many of them were unquestionably of otogenic or hemogenic origin and were of the adjacent type, a number of post-traumatic abscesses consequent to injuries received in the World War may have been included. An abscess of this type is easier to diagnose and cure surgically than a contiguous abscess from sinus disease. Puusepp reports 44 recoveries among 55 cases of traumatic abscess (80 per cent). Alajouanine and Petit-Dutaillis report 32 cases with 22 recoveries (70 per cent). These figures could of course be multiplied. They have been selected with some care to give results from the larger clinics in various countries.

Neumann, in commenting upon the comparative figures in the Austro-German Clinics and upon Macewen's record, stated that in his opinion the reasons for the latter's success were that he refused to operate in the presence of meningitis or other serious complications, that he operated through a relatively clean field which had been painted with 20 per cent carbolic solution, and performed the operations himself, personally supervising the after-care. The reviewer in reading what details are available on these series of cases was struck with the high percentage of meningitis as a postoperative sequel (Fremel). Furthermore, since in the great majority of them the abscess resulted from otitic suppuration, the complications inherent in infection in this area, i.e., sinus thrombosis, petrositis, meningitis, had all to be contended with.

When abscess of the brain develops in the presence of thrombosis of the sinuses, establishment of the fact that the abscess exists may be extremely difficult, if not impossible. If, in the absence of involvement of the lateral sinus, an abscess develops without positive evidence betraying its presence, the stormy course of the usual thrombosis of the lateral sinus will almost certainly cover up the less obtrusive symptomatology of the abscess formation.

Mygind reports the results of 207 cases of various intracranial complications of otogenous disease. Among these were 43 brain abscesses with but 4 recoveries. He shows that any patient with an intracranial suppuration faces a higher mortality with the development of a new complication. Among these 207 cases 35 per cent had more than one intracranial lesion. Of these, 50 had a spread of the original infection into a second area with but 24 per cent of recoveries; 10 cases had 3 pathological processes with 12 per cent of recoveries, and 7 cases had 4 different intracranial suppurative lesions with no recoveries. Eaddy and Sekerak report 9 cases of meningitis and death among 14 brain abscesses.

However, in all these series of cases, there was obviously much too much exploration of the brain through an infected dura as a last resort in a desperately sick patient. Diagnosis was bad, localization worse. Too many fingers and hemostats were thrust into the brain in searching for the abscess. Methods of drainage were inadequate. Again a careful study of the figures will show that relatively few cases of abscess were encountered by any one operator. Consequently, no single surgeon had sufficient experience to enable him to develop a satisfactory technique. Certainly none of them had encountered personally and in as short a time as large a number of abscess cases as had Macewen.

The situation the otological surgeon has had to face has always been serious when the presence of a brain abscess has been suspected. The mastoid area or paranasal sinuses are infected and present themselves in the line of the proposed drainage tract. How can the position of the ab-

scess be determined and adequate drainage obtained without infecting the subarachnoid space and producing meningitis? Should an operation for abscess be done through a clean field, separate from the primary focus? Piquet, Moulonguet, Ombrédanne, Andre-Thomas, and Laurens and Girard, Aboulker and Badaroux, Ramadier, et. al. have discussed this problem at length. The advantages connected with working through the primary focus of infection in draining an adjacent abscess are that the septic process can be thoroughly eradicated and the course of the infection through the bone can be determined, which reveals a definite clue as to the site of the abscess. Furthermore, an extradural abscess which may give a clinical picture that closely simulates a subcortical abscess can be found and drained. Finally, if granulation tissue, thickening, or other change is found on the dura, the subarachnoid space is usually sealed off by adhesions beneath this region and a plunge for abscess and drainage through this area may not result in meningitis. The disadvantages of plunge for abscess and the establishment of drainage through an infected field are that the operator is cramped for space in instituting drainage, and that he is entering the brain through an infected field. If no abscess is found, the introduction of a cannula may well carry in infection and cause meningitis or encephalitis.

On the other hand, if exploration for abscess is made through a clean field away from the infected mastoid or frontal sinus, the puncture, if negative, will do no harm. However, if the abscess is reached, drainage must be undertaken through the subarachnoid space in an area unprotected by adhesions. This danger can be overcome by only opening the dura at first and then waiting from twenty-four to forty-eight hours for adhesions to form before exploration is made and drainage established. Much more room for surgical manipulation and the introduction of drainage can be obtained through a clean field. However, by this maneuver the original source of infection is not eradicated, which may lead to the reappearance of the abscess in spite of apparently adequate drainage.

Moulonguet, in an attempt to settle this question, reviewed the literature from 1906 to 1914. He found the following statistics: cases operated on by the mastoid route—81, with 39 deaths and 42 (53 per cent) recoveries; operation through the mastoid with marked enlargement of the opening in the bone—19 cases, with 8 deaths and 11 (59 per cent) recoveries; operation through a clean field—23, with 6 deaths and 17 (73.9 per cent) recoveries. However, Dench in 1907, in collecting the literature up to that date, reports that of 37 patients with abscess operated upon through a sterile field 18 (49 per cent) recovered and 19 died, whereas of 41 operated upon through the avenue of infection 27 (66 per cent) recovered and 14 died. In this same paper, Dench provides figures in an attempt to clear up the point as to whether a cerebellar abscess should be opened in front of or behind the lateral sinus. He states that among 45 patients in whom the incision was made behind the sinus 25 (55 per cent) recovered and 20 died; whereas of 11 in whom the incision was made in front of the sinus 4 (36 per cent) recovered and 7 died. Eagleton and others have recommended obliteration of the sinus between ligatures and incision through its posterior wall in drainage of a cerebellar sinus.

In recent years various efforts have been made to prevent many of the postoperative complications following drainage of an abscess. Lemaitre in 1920 suggested the introduction of a small needle through the area of dural granulation over a suspected abscess, the aspiration of a drop or two of pus in confirmation of its presence, and withdrawal of the needle. On subsequent days larger needles and, finally, a filiform catheter were introduced along the drainage tract to dilate it slowly and to prevent meningitis by keeping within the area of subarachnoid adhesions. Dowman in 1923 suggested that the dura be opened and packed off to produce adhesions before drainage was attempted. Moulonguet believed that dural incision alone was sufficient because the intracranial pressure would force the cortex out through the incision and thus create adhesions (Bouton cérèbral). The difficulties with the introduction and maintenance of adequate drainage were attacked in two ways. King in 1923 suggested that a large defect in the skull be created over the abscess, the overlying cortex removed, and instead of the introduction of drainage, the abscess be permitted to herniate out through the opening. Spasokukotsky, in 1916, and Dandy, in 1926, stated that a simple tap of the abscess through a small trephine hole with a hollow needle on one or more occasions with evacuation of pus would result in a cure. Lastly, Vincent has advocated a craniotomy and removal of the encapsulated abscess *en masse*, without drainage, in a manner similar to the extirpation of a solid tumor.

The operations directed against a brain abscess fall into two groups and depend upon the size of the opening in the overlying cranial bone. A group of neurosurgeons following the excellent

results obtained by Coleman believe that a small trephine opening plus tap, or tap and the introduction of a small soft rubber catheter as a drain will result in the cure of the great majority of solitary brain abscesses. A second group, which appear to comprise the otologists and the majority of neurosurgeons, use a much larger opening in the bone, incise or excise the cortex down to the abscess wall, evacuate the pus under direct vision, and either pack the abscess cavity with iodoform gauze and rubber drains or leave it wide open and thus invite herniation. The advantages of the first method are that the abscess is drained with a minimum of destruction of the overlying cortex, which reduces the neurological sequelæ, and with the least possible disturbance of the brain adjacent to the abscess, which renders the spread of encephalitis about the abscess less likely. The definite disadvantages of this method are the possibility of imperfect drainage and lack of relief of the increased intracranial pressure because the trephine opening is entirely too small to afford it. The advantages of the second method are adequate drainage and relief of pressure. Its disadvantages are chiefly destruction of the cortex which may perpetuate or even increase the neurological symptoms and result in severe sequelæ. Furthermore, this method cannot be used when a deep-seated and heavily encapsulated abscess is encountered.

Grant in 1938 reviewed the records of 31 cases of brain abscess followed for at least a three-year period. Twenty-three had been treated by simple tap or tap and drainage through a small trephine hole in the bone. Five of the patients had neurologic sequelæ which kept them from working at their original occupations. The remaining 17 had no physical impairment. Eight had had the abscess attacked of necessity through a large opening in the bone with destruction of the cortex overlying the abscess. Seven of these patients were so crippled as a result that a return to their former economic status was out of the question.

Several facts have emerged as a result of the experiences of the last fifty years. With the exception of the acute metastatic abscess which may demand urgent drainage (King), brain abscesses are not generally considered surgical emergencies. It is true that too long delay may be just as fatal as too early surgery resulting in a spread of encephalitis, because of rupture of the abscess into the ventricle or because of a sudden increase of the intracranial pressure. Furthermore, only too often cases are admitted to the hospital in serious danger from increased intracranial pressure, and demand immediate drainage. However, for the most part when the formation of an abscess is suspected, the surgeon has learned to wait for encapsulation before operating. This waiting period can be well spent in eliminating the infectious focus in the sinus and in determining with complete assurance the localization of the lesion. Again, much greater care is taken to prevent meningitis. The neurosurgeon for the most part operates through a clean field, while the otologist, being more experienced in working through the involved sinus, chooses this region for drainage. However, by either approach, experience now dictates that if the patient's condition permits the dura be opened and gauze impregnated with a mild antiseptic be placed against the brain for from twenty-four to forty-eight hours to create adhesions walling off the subarachnoid space. The importance of the use of sulfanilamide and its compounds in the prevention of meningitis needs no emphasis. Bucy and Rowe have shown that it is effective in the prophylaxis and cure of this heretofore almost uniformly fatal complication of a brain abscess. Soft rather than rigid drainage material is advisable because a rigid tube may penetrate the posterior wall of the abscess. Irrigation through the drainage tube is generally decried, unless it is done with extreme care to prevent increased pressure within the abscess cavity. The tube through which irrigation is carried out should be much smaller than the drainage tube to permit ready escape of the fluid.

No one of the methods described is applicable to every case of abscess. In certain instances all of them—a small trephine opening, tap, tap and drain, the enlargement of the cranial defect with cortical incision or excision down to the abscess wall, opening of the abscess and the introduction of packing, and, lastly, complete enucleation of the abscess and its capsule—may be necessary before cure is effected.

THE SURGERY OF BRAIN ABSCESS

Review of the more important details of the two types of surgical attack on a brain abscess seems indicated. The proper anesthesia for these procedures is pre-operative preparation with small amounts of morphine (1/6 gr.) and scopolamine (1/300 gr.) plus skin infiltration with ½ per cent novocaine. If the patient is particularly apprehensive, avertin (from 70 to 90 mgm. per kilo of body weight) may be given by rectum. Inhalation anesthetics should be avoided as they tend to raise intracranial pressure. The reviewer believes that sulfanilamide or one of its compounds should be administered in full dosage the day before operation and continued thereafter if

an organism susceptible to its effects is isolated from the abscess cavity. When the abscess is due to sinus infection, the primary focus in the mastoid or paranasal sinuses should, if time permits, be thoroughly eradicated. If on neurological examination alone the localization seems exact, a trephine opening is made under local anesthesia, over that area, and the dura laid back as widely as the small opening in the bone permits. Cairns has pointed out that valuable information may be obtained from inspection of the subarachnoid space over the region in which an abscess is presumed to lie. When the subarachnoid space is filled with fluid, the symptoms may be due to a localized serous meningitis, the pseudo-abscess of Adson and Nielsen and Courville. If the indications for immediate puncture are not too urgent, the wound should be packed with gauze soaked in a mild antiseptic solution, or the dura, arachnoid, and pia about the opening should be coagulated with the electrosurgical unit and the incision closed. It should then be reopened in from twenty-four to forty-eight hours and a plunge made for the abscess with a ventricular cannula. If no resistance is encountered or the ventricle is entered, the localization is incorrect. Inasmuch as current neurological signs have been proved of uncertain value, air studies may now be justified. However, since ventriculography in the presence of a brain abscess is not without a certain risk, the reviewer believes that it should be employed only after routine methods of localization have failed.

However, if a definite sense of resistance is obtained when the cannula is inserted, the presence of the lesion is certain. Two courses are now open. The needle is introduced into the abscess cavity, the stylet removed, and a few drops of pus are allowed to escape for smear and culture. If the smear shows but a single group of organisms in three or more high-power fields, the reviewer believes that the pus should be completely evacuated by changing the position of the patient's head and increasing the intracranial pressure by jugular compression. With the coagulating current applied to the needle it is slowly withdrawn, thus searing and sterilizing the needle tract. The wound is now closed. Many an abscess has been cured by a single or repeated taps (Dandy, Grant, Puusepp, Spasokukotsky, Patrikios and Sbarounis, Vincent *et al*).

If the pus contains many organisms on smear, a small rubber tube (Coleman) is inserted into the abscess for drainage. The trephine opening and the dural incision will require slight enlargement to facilitate passage of the tube. The tube should be introduced before withdrawal of any amount of pus, otherwise the accurate introduction of the tube cannot be ascertained by the escape of pus through its lumen. The special needle and sleeve described by Grant is of value in inserting the tube into the capsule. The tube should be placed within the cavity, care being taken not to introduce it too far lest it come in contact with the posterior wall of the abscess and possibly penetrate it. The tube is now sutured to the galea and cut off at the level of the skin. The wound is loosely closed around the tube. The dressing is built up around its mouth to prevent obstruction by overlying gauze. The tube is left *in situ* for a week, then the suture is cut and the tube allowed to extrude in the course of the next two or three weeks. Worms has suggested repeated daily aspiration of pus through the tube, and Ferey confirms his statement that drainage is improved in this way. The reviewer has never been able to obtain pus by aspiration and does not believe in irrigation through the tube except with extreme care. Postoperatively it is important, for the first few days at least, to keep the patient's head in that position which will facilitate drainage. If intracranial pressure appears as a threatening postoperative complication, it may be controlled by saline laxatives or hypertonic solutions by vein, by repeated tap of the ventricle contralateral to the abscess, or, if these measures fail, by a contralateral subtemporal decompression.

Coleman emphasizes, and in this we are in hearty agreement, that if after the passage of the brain cannula into the abscess the subsequent introduction of the drainage tube seems difficult, any attempt to force it into the capsule should be avoided. The cavity should be drained through the needle as thoroughly as possible, the cannula withdrawn, and several days allowed to elapse before another attempt to introduce the tube is made. Coleman reports 26 cases of solitary encapsulated abscess with 21 recoveries following this method of tap and drainage through a small opening; Grant reports 20 recoveries among 30 cases of abscess of this type.

In the reviewer's opinion, the surgical procedure just described is applicable to any abscess in any area. Certain deep-seated, heavily encapsulated cerebral abscesses are difficult to treat by any method. In cerebellar abscess these maneuvers are particularly useful, because the heavy muscles overlying the occipital bone make wide exposure difficult. A cerebellar abscess is usually small and deep-seated and not often heavily encapsulated, lending itself better to tap or tap and drain than to wide open exposure.

The second or open method of draining an abscess has been adopted by the majority of operators. Once the capsule of the abscess has been identified by the exploring cannula, the skin incision is enlarged either as a longer straight incision or in a three-legged Isle-of-Man fashion (King). The pericranium is stripped off the bone and the trephine opening widened to a size of about 4 by 4 cm. The dura is now opened in a stellate fashion in segments from the center outward, so that the openings in the dura and bone are about equal in size. The subarachnoid space is sealed off by packing narrow selvage gauze soaked in one-fourth strength tincture of iodine between the dura and arachnoid for twenty-four hours (Bucy), by suturing the dura to the cortex with fine catgut sutures (King and Adson), or by coagulating the dura, arachnoid, and pia to the cortex with the electrosurgical unit (Cahill and Horrax). The cortex is now either incised (Adson and McKenzie) down to the abscess wall, or excised and removed with the electrocautery or suction (Bucy, Kahn, King, Tobey, Bagley), until the surface of the abscess capsule is exposed. The surrounding brain is held back by gentle retraction against sponges soaked in a mild antiseptic solution. After pus has been evacuated through the exploring needle to avoid contamination of the wound, the abscess cavity is opened, the edges of the incision are retracted, the remaining material is sucked out under direct vision, and the inner wall gently cleaned of adherent masses of necrotic matter. The whole extent of the abscess is thus exposed and diverticula, if present, are opened up. The abscess cavity is now packed, and kept open with selvage gauze, which may or may not be impregnated with antiseptic material. McKenzie simply places a fairly large, soft rubber tube in the cavity without gauze. Robison fills the cavity with long strips of rubber tissue. Adson and Bucy use iodoform gauze, packing it about two small, soft rubber catheters in the center as drains. King uses iodoform gauze alone without rubber drains. He avoids drains, for he fears that they may penetrate the posterior wall of the abscess. All the operators who use gauze bring the ends of the packs out of the cavity all about the circumference of the opening in the bone, thus protecting the incised surface of the brain from infection and further walling off the subarachnoid space. Mosher suggested a conical wire-mesh basket as a drain which fits snugly into the abscess cavity, holds it open, and thus permits efficient drainage. The open end of the wire mesh is sutured to the skin to hold it in place during the early days of healing. At the end of four or five days the suture is cut, the drain is loosened by rotating it, and it is gradually allowed to extrude itself. Cahill reports successful cure of 12 consecutive cases of abscess, 9 cerebral and 3 cerebellar, all otogenous in origin, all chronic and encapsulated, with the use of this drain. Kaplan describes 5 cases in which the patients recovered, although in 2 of them the wire-mesh drain did not function successfully and had to be removed. Horrax evacuates the pus, opens the capsule, pulls it upward into the defect in the bone, and sutures it to the galea or pericranium, thus marsupializing the abscess and using the capsule to protect the cut brain surface and the subarachnoid space. Light packing is used in the cavity. Muck calls attention to changes in the size of the abscess cavity when first opened, with shift in position of the patient's head. The insertion of drainage, especially in an abscess low down in the temporal lobe, can thus be made much easier.

Kahn has recently made an important suggestion. The presence of the abscess capsule is identified by the exploring cannula, the opening in the bone is enlarged, and the dura is opened. All the pus is evacuated through the needle, and 5 c.cm. of thorotrast are introduced. The exploring cannula is now removed, iodoform gauze packed against the surface of the brain, and the skin lightly sutured. The thorotrast in the abscess cavity outlines its size and position roentgenographically. Subsequent roentgen-ray studies of the abscess show that it slowly progresses outward toward the surface of the brain beneath the opening in the bone. One abscess was actually found beneath the skin, having been forced outward through the defect. As a rule, however, the cortex herniates through the operative wound as the abscess migrates toward the surface. This extruding brain is removed by suction, the abscess cavity being opened, evacuated, marsupialized, packed, and drained. Kahn has had success in 3 of 4 cases treated in this manner.

In all of these variations of the open method of treatment, removal of the gauze packs begins after the first week. King irrigates his packing continuously with an azochloramide solution, but Adson, Bucy, and Horrax do not use irrigation. Removal of the gauze begins on the fifth postoperative day and is completed by the tenth or twelfth. Care is necessary in removal of the gauze lest damage be done the abscess wall. The gauze should be moistened during withdrawal to loosen its too firm adhesion to the capsule. If rubber drains have been inserted, they are freed from their suture at the skin margin as the last of the gauze is withdrawn. Within the next two weeks

the drains have usually been extruded spontaneously by the closure of the cavity. The reviewer agrees with King that the postoperative dressings of an abscess should be done personally by the operator and not turned over to an assistant. These wounds need constant supervision by a single, well-trained observer. A shift in the responsibility may easily result in disaster. Herniation of the brain through the wound should be checked at the skin margin by the intravenous administration of glucose, a saline laxative, mild dehydration, elevation of the head of the bed, or lumbar puncture. If in spite of every effort the ventricle ruptures into the wound with a leak of the cerebrospinal fluid, the foot of the bed should be elevated, fluids should be forced (from 4,000 to 5,000 c.cm. in twenty-four hours), and the leak should be allowed to continue (Bucy). If unaccompanied by a spreading encephalitis, spontaneous cessation of the leak will result. McGuckin reports 3 such cases. Sulfanilamide is always indicated under these circumstances.

Careful nursing is of extreme value in every case of abscess. Nutrition must be maintained at all costs. The bowels should always be kept free. Mild sedatives are indicated, for the more rest these patients can have the better the results will be.

A cerebral fungus is a very awkward complication of brain abscess. Usually it is due to spreading encephalitis which forces the brain outward through the craniectomy and causes strangulation of the extruded tissue by pressure against the dura. A fungus may reach a very large size in a short time if the infection behind it is acute. Prevention is better than cure. When it occurs repeated lumbar puncture, ventricular tap, or even a contralateral subtemporal decompression may be necessary to control pressure. Increase in the size of the opening in the bone and dura about the base of the fungus (Aloin) may reduce the edema due to interference with venous return. Conservative treatment and careful protection of the fungating mass by vaseline-gauze dressings and a surrounding gauze doughnut are indicated. Amputation at the base is, in the reviewer's opinion, of little use unless at the same time an abscess is entered and pus evacuated. Amputation in our experience has usually resulted in rapid reappearance, especially in the acute cases. In the chronic cases the surface may be painted every second day with a 1 per cent solution of formaldehyde. An eschar is slowly formed. As it contracts and as the intracranial infection clears up recession will gradually occur (Holmes, Puusepp). Once the eschar has formed, the application of perforated adhesive strips across the dome of the fungus to make constant pressure against it will help in causing it to recede (King).

Certain types of abscess in certain areas are especially difficult to cure. Alajouanine, Maissonett, and Petit-Dutaillis, in discussing post-traumatic abscess, review 91 cases, among which were 32 frontal abscesses with 9 deaths (28.1 per cent), 24 parietal with 14 deaths (58.3 per cent), 8 temporal with 3 deaths, (35.6 per cent), 14 occipital with 5 deaths (35.6 per cent), and 4 cerebellar with no deaths. Bruskin reports 12 frontal abscesses with 2 deaths (16.6 per cent), 18 parietal with 11 deaths (61.1 per cent), and 8 occipital with 3 deaths (37.5 per cent). As has been noted, a post-traumatic abscess is prone to be chronic and heavily encapsulated. The formation of a thick capsule has made cure by ordinary drainage methods very difficult. The wall is so heavy that it does not collapse after evacuation of the pus. In the reviewer's experience a frontal-lobe abscess due to sinus disease, especially in the ethmoids and sphenoids, is very prone to be adherent to the dura over the sphenoid ridge. In consequence of this adhesion the abscess always remains deeply seated and satisfactory drainage with eventual cure is difficult to accomplish.

In 1928, without recounting any details, Sargent stated that he had deliberately attacked heavily encapsulated post-traumatic abscesses with a technique similar to that used in extirpation of a tumor, and had removed them *en masse* without rupture in 5 cases. Morton in 1932 reports that Dott had had a similar case, and Cairns, in 1934, stated that complete removal is the only way in which these heavily walled lesions can be successfully handled. Isolated reports of total extirpation of a presumed tumor which later on section turned out to be an abscess appeared from the neurosurgical clinics. Adson, and Yaskin, Grant, and Groff record such cases. However, Vincent and his group in France have been the first to advocate the deliberate removal *en masse* of an encapsulated brain abscess and to insist that if sufficient time were allowed to elapse the abscess wall would acquire the proper consistency to make complete extirpation practical. Their various reports contain details in 13 cases, in 10 of which the patient recovered. Among these abscesses 7 were frontal and 5 temporal. In 9 instances the localization was verified by ventriculography. A single cerebellar abscess was thus removed, but unfortunately the patient did not recover. In every case the abscess was subacute or chronic. Two patients with cerebral abscess died.

The technique consists in accurate localization of the lesion as a primary step. A bone flap is turned down over the area indicated and through a small incision in the dura an exploring cannula is introduced. When this encounters the capsule, the amount of pressure necessary to penetrate the wall determines the next step. If the capsule is thin and easily penetrated, Vincent believes that it would be too fragile to permit of complete extirpation without rupture. Consequently, the abscess is drained, the needle removed, the nick in the dura sterilized and closed by coagulation, and a muscle graft is implanted. A decompression for temporary relief of intracranial tension is afforded by removal of bone at the base of the flap, and a trephine opening is made in the bone flap over the incision in the dura for future tap of the abscess if this is required. The flap is now replaced but not secured except by skin suture. No drainage is necessary. Vincent claims that adequate relief of pressure can be obtained without opening the dura if the overlying bone is removed. He substantiates this claim by illustrative cranial roentgenray films which show elevation of the bone flap in spite of the fact that the dura had not been opened. If the symptoms recur and the bone flap is elevated by pressure, the abscess is evacuated through the trephine hole with careful estimation of the amount of pressure necessary to penetrate the capsule. When the abscess wall is sufficiently firm to make it seem probable that complete removal without rupture can be carried out, the original incision is reopened, the bone flap reflected, the cortex is incised or excised down to the abscess, and the abscess is dissected out *en bloc*. In 3 cases the capsule was found to be so firm to the exploring cannula at the time the first osteoplastic flap was turned down that immediate removal was done. However, in 8 cases one or more taps were necessary before the capsule had become sufficiently strong to justify complete extirpation. In all these cases, following total ablation of the abscess, the dura was carefully closed, the flap replaced, and the skin sutured without drainage. When it is realized that the weight of most of these abscesses varied between 100 and 150 gm. and that the postoperative convalescence in the majority of cases was no more stormy nor prolonged than would have been the case if a tumor of equal size and in the same position had been removed, this method of Vincent's should be given careful consideration. To the reviewer these results are a direct confirmation of his opinion that delay to permit the abscess to become walled off and encapsulated is the most important single requirement if a surgical attack on a lesion of this type is to be successful. Furthermore, the reviewer is surprised that he and others have been able to produce apparent cures in cases of brain abscess by single or repeated taps without the introduction of drainage. Judging by Vincent's report, a tap simply relieves intracranial tension temporarily, permits the better formation of the abscess capsule, increases the chronicity and, at times, the size of the abscess, but never actually results in complete sterilization and healing.

A review of the literature concerning brain abscess shows unquestionably that the best surgical results follow drainage after encapsulation has occurred. Adson, Bagley, Bucy, Cahill, Coleman, Davidoff, Grant, Horrax, Kahn, Kaplan, King, McKenzie, Mayfield and Spurling, and Vincent have published series of cases limiting their statistics for the most part to the surgical results with solitary encapsulated abscess. Admittedly, these figures do not represent the total mortality, for cases of acute abscess and of abscess contiguous to the mastoid accompanied by the frequent and serious complications of otogenic infection have for the most part been omitted. However, the figures show that if circumstances permit delay until encapsulation occurs, the mortality consequent upon drainage of a solitary discrete abscess should not exceed 20 per cent. However, it is the reviewer's opinion that while these selected case series show a relatively satisfactory mortality rate, if neurosurgical or otological consideration was taken of every case admitted to a clinic, in which a final diagnosis of brain abscess was made by operation or autopsy, whether that abscess was acute or chronic, adjacent or metastatic, solitary or multiple, and regardless of complications or the patient's condition on admission, the average mortality from brain abscess would be about 40 per cent.

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SURGERY OF THE NERVOUS SYSTEM

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Brody, B. S.: The Management of Acute Craniocerebral Injuries. *J. Am. M. Ass.*, 1940, 115: 977.

Citing Munro's classification of craniocerebral injuries, and his report of 1,450 cases, the author points out that 1,211 patients of that series could be classed as non-operative. The great majority of patients with craniocerebral injuries recover with bed rest, supplemented in some instances by lumbar puncture or hypertonic solutions. For simple concussion the treatment should be bed rest for from ten to fourteen days. Diagnostic spinal puncture is advisable during the first week. If the spinal fluid is bloody, the condition is more than concussion and a longer period of bed rest is necessary. The treatment of cranial injury resolves itself into three categories: first, the prevention of infection, second, the treatment of increased intracranial pressure, and, last, the management of depressed fractures.

The prevention of infection depends on prompt and efficient treatment to lacerations of the scalp, and the administration of antiserums in cases of contaminated wounds. Fractures through the mastoid or paranasal sinuses, as evidenced by cerebrospinal otorrhea or rhinorrhea, may be followed by meningitis. Sulfapyridine should be given to these patients as a means of prevention, since the pneumococcus is the most common invading organism. Patients with rhinorrhea should be isolated in order to minimize exposure to respiratory infection. Intranasal therapy and intra-aural examination should be avoided when there is bleeding, or spinal-fluid leakage from the nose and ear, respectively. Since most cases of spinal-fluid leakage stop spontaneously, covering the ear with a sterile dressing and encouraging dependent drainage are all that is necessary.

The incidence of aspiration pneumonia in comatose patients has been reduced by elevating the foot of the bed 12 in. continuously or intermittently, as indicated by vomiting or the accumulation of mucus. The possible disadvantage of thus increasing intracranial pressure is outweighed by the gravitation of secretions away from the lungs.

The treatment of increased intracranial pressure depends on the diagnosis. Extradural or subdural hemorrhage with classic signs obviously demands operative intervention, but atypical cases of extradural or subdural hemorrhage present a difficult diagnostic problem. Thorough neurological examination on admission and at frequent intervals thereafter is an aid in the diagnosis of these cases. A persistently elevated cerebrospinal-fluid pressure is usually observed. When a hematoma is suspected, multiple trephine openings are indicated.

The proper management of depressed fractures requires prompt surgical treatment, and débridement of compound depressed fractures. If the fracture is not compound, operative treatment is usually not indicated unless the depression materially reduces the size of the intracranial cavity. Late epilepsy is due to the formation of a cicatrix rather than to the irritative effects of the depressed fragment itself. Elevation should be confined to fractures of a fragmented or spiculated nature in which the dura has been lacerated and the brain traumatized.

Patients with widespread cerebral lesions in the nature of multiple lacerations and contusions, petechial hemorrhages, or extensive hemorrhages into the brain stem from the vein of Galen, with associated edema and cell damage, and who survive the immediate critical period and gradually return to consciousness after days or weeks are the ones in whom repeated lumbar puncture and the conservative use of hypertonic solutions have their best clinical application. These measures should not be carried beyond the stage of demonstrable increased spinal-fluid pressure. Overdehydration should be avoided. A daily fluid intake of 1,500 c.cm. is adequate for afebrile patients; proportionately larger amounts are necessary for those with fever. It appears wise to refrain from spinal puncture during the first twenty-four-hour period. Some of the possible dangers of the indiscriminate use of therapeutic spinal puncture are pointed out. In general, the author suggests that sedatives, especially morphine, be avoided. JOHN L. LINDQUIST, M.D.

Allen, A. M., Moore, M., and Daly, B. B.: Subdural Hemorrhage in Patients with Mental Disease. *New England J. Med.*, 1940, 223: 324.

This is really an analytical study of autopsies performed in institutions under the jurisdiction of the Department of Mental Health in Massachusetts.

Thirty-one hundred autopsies were performed from July, 1914, to July, 1934. The purpose of the analysis was to examine the cases of subdural hemorrhage found in patients with mental diseases. In the 3,100 autopsy protocols examined, there was evidence in 245 cases (7.9 per cent) of subdural hemorrhage of varying degree and in varying locations. In 35 of the cases subdural hemorrhage was considered to be the primary cause of death; 45 showed other types of intracranial bleeding. Death from subdural hemorrhage was found in all decades of life, but by far the greatest number of deaths occurred in patients between sixty and seventy years of age. When classified according to psychosis, 79 patients were found to have mental disorders associated with old age, such as arteriosclerosis and senile conditions. It was believed that atrophy of the brain in these cases may have predisposed to subdural hemorrhage from unprotected and unsupported friable veins. In addition, the physical instability of the patients may have predisposed them to falls and minor traumas.

Among epileptic patients, 22 showed subdural hemorrhage in 178 autopsies. The epileptics also showed other evidence of violence, for a fractured skull was found in 11.

The studies involved in this article tend to support the view that senility, syphilis, alcohol, and trauma are factors in the production of subdural hemorrhage. The authors lay stress on the factors of nutrition and vitamin reserve. They believe that if these factors are studied and compared with a series of severe head injuries, the conclusion may be reached that trauma is not as important to hemorrhage as has hitherto been supposed. The majority of the hemorrhages were large and diffuse, and involved a large part of the subdural space. However, in many cases the hemorrhage was small and obviously of recent origin.

The problem of diagnosis of subdural hematoma in psychotic patients is not discussed, but the article confirms the opinion that patients institutionalized for mental disease should have periodic, complete neurological examinations. In all probability, many patients could have been given relief if their conditions had been diagnosed.

ADRIEN VERBRUGGHEN, M.D.

SPINAL CORD AND ITS COVERINGS

Andersen, T.: The Frequency of Prolapsus Disci Intervertebralis as a Cause of Sciatica. *Acta med. Scand.*, 1940, 104: 427.

Because it seemed desirable to know whether we would have to reckon with posterior intervertebral disc prolapse or thickened ligamentum flavum as a frequent cause of idiopathic sciatic neuritis, it was decided, in Medical Department B of the Copenhagen County Hospital, Gentofte, to perform myelography, throughout a certain period, on all patients admitted with pronounced symptoms of sciatic neuritis, if other methods of examination (gynecological examination, rectal exploration, roentgenography of the vertebral column and pelvis) gave no evidence of any lesions of bones or soft tissues that might explain the symptoms.

Eight patients with symptoms of sciatic neuritis met these requirements. In all of them, myelography showed localized defects in the contrast shadow which were consistent with the symptoms of the patients in every instance. Operation performed on 3 of these patients revealed prolapses of 2 discs in 1 patient, a thickened ligamentum flavum in 1, and disc prolapse together with thickened ligamentum flavum in 1. In each case the operative finding corresponded to the myelographic finding.

In the remaining 5 non-operated patients, it is reasonable to assume that the lesion corresponded to the myelographic picture.

It is pointed out that there is a striking resemblance between the classical picture of sciatica and the typical cases of intervertebral-disc prolapse or thickened ligamentum flavum in the lower part of the lumbar column. Correlating this fact with the result of the examinations reported, the writer arrives at the conclusion that the pronounced, apparently idiopathic, sciatic neuritis (neurogenic sciatica) in most cases is probably due to some intraspinal lesion, particularly to intervertebral-disc prolapse or thickened ligamentum flavum.

The writer finds it advisable not to employ myelography as a routine method, and to use it only in the cases of patients who are so disabled by their illness that operative treatment is to be recommended if the myelogram shows evidence of an intraspinal lesion.

In a great majority of cases, therefore, the treatment should be conservative and should be directed at the symptoms, especially the muscular disorders.

Just as it is true that far from every instance of sciatic neuritis is ascribable to the aforementioned lesions, it is also true that these lesions are far from always giving rise to sciatic neuritis. The symptoms will depend upon the site in the spinal canal where the disc prolapse or the thickened ligamentum flavum is located.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Fitzwilliams, D. C. L.: A Plea for a More Local Operation in Early Breast Carcinoma. *Brit. M. J.*, 1940, 2: 405.

Many years ago the author suggested a local operation for early carcinoma of the breast. This conservative procedure has begun to receive recognition, especially in the United States where the radical operation originated.

The author describes an early carcinoma, in the sense that he uses the term, as "one in which there is a faintly perceptible something in the breast—hardly a lump and certainly not a tumour. It has no well-marked textbook characteristics of malignancy. These tumors have one invariable characteristic which is all-important for diagnosis—they throw a shadow on transillumination with a strong light." Transillumination is the only method by which they can be diagnosed.

The author states that he has overstepped the limits of safety as laid down by himself, and has done local operations in some cases in which the skin had just begun to be dimpled.

One hundred and twenty-eight patients were subjected to the local excision by the author, only a small segment of the breast being removed. However, only 93 of these were found to be suitable for this procedure, and the following statistics are based on these.

Five patients were lost sight of, but of this group, 1 was known to have been well for nine and one-half years, 1 for eight years, 1 for three and one-fourth years, and 1 for one and one-half years.

Of the remaining 88 patients, 47 were reported to be living with no recurrence. The period of survival in this group ranged from two and one-half to fourteen and one-half years. Fifteen patients had metastases, 12 local and 3 distant. Twelve patients died of intercurrent disease, their average survival period being seven years. The longest survival period was eighteen years. Fourteen died of carcinoma, 3 with local recurrence, and 11 with metastases.

EARL O. LATIMER, M.D.

TRACHEA, LUNGS, AND PLEURA

Dick, J. C.: Carcinoma of the Bronchus. An Investigation into the Incidence and Pathological Features of 131 Cases from Glasgow Royal Infirmary. *Glasgow M. J.*, 1940, 134: 63.

The article is divided into 5 sections, namely, introduction, general features, features of the different histological types, metastases, and the summary.

The bronchus is now recognized as one of the common sites of carcinoma. The incidence in the ten-year study was shown to be at its peak in 1935. The number of cases of carcinoma of the bronchus in which autopsy was made is compared with the total numbers of autopsies and of admissions in the five-year periods from 1909 to 1938. In this period the incidence of bronchial carcinoma has more than doubled as judged by the most conservative estimate, i.e., the percentage of admissions, and in view of the more general classification in the earlier years may be considerably more.

The age incidence is given, which shows that more than 85 per cent of the patients were between the ages of forty and seventy years. The youngest was twenty-one years. There is considerable difference in the age incidence in the various histological types.

The site of the carcinoma in the bronchial tree was in the upper bronchus in nearly one-half of the cases and on the right side in three-fifths of them.

Pulmonary tuberculosis, silicosis, occupation, and the presence of adhesions are discussed in relationship to the cause of bronchial carcinoma.

The following different histological types are considered in some detail: small round and oat-celled carcinoma, adenocarcinoma, anaplastic adenocarcinoma, small round and oat-celled adenocarcinoma, spheroidal-celled carcinoma, squamous carcinoma, adenocarcinoma with squamous metaplasia, carcinoma of the lung alveoli, and conditions not classified. The summary of the distinctive findings in the different histological types are as follows:

TABLE I.—CARCINOMA OF THE BRONCHUS

Type	Age	Sex	Marked Silicosis	Metastases	Duration
(a) Small round and oat-celled	Average	48 M. 9 F.	20 of 57	Widespread	Great variation
(b) Adenocarcinoma	Average	1 M. 4 F.	All	Widespread	Variable
(c) Anaplastic adenocarcinoma	Marked variation	15 M. 2 F.	2 of 17	Numerous and widespread	Long
(d) Mixed (a) and (b)	Average	3 M. 2 F.	2 of 5	Widespread	Usually over six months
(e) Spheroidal	Average	All Males	1 of 7	Widespread	Very short
(f) Squamous	Older	All Males	None	Present in all	Short
(g) Mixed (b) and (f)	Rather older	All Males	5 of 9	Widespread (2 with none)	Average five months
(h) Lung	Old	All Males	None	Not marked	Fairly rapid

SUMMARY

One hundred and thirty-one cases of bronchial carcinoma which came to autopsy at the Glasgow Royal Infirmary in the years from 1929 to 1938 are discussed as to frequency, increased incidence, age and sex incidence, and distribution in the bronchial

tree. Various possible etiological features are reviewed.

Histological examination showed a considerable diversity of types, and several of the groups possessed special characteristics, as follows:

1. Small round and oat-celled carcinoma was the commonest variety.

2. Spheroidal-celled and squamous carcinomas ran the most rapid course.

3. Carcinoma of the lung alveoli and squamous carcinoma occurred at a later age than the other types and only in male subjects.

4. Anaplastic adenocarcinoma ran a longer course than the other types.

Metastases occurred very frequently and in 24 cases caused the clinical symptoms, the primary condition being silent. CARL R. STEINKE, M.D.

Marano, A., Cardeza, A. F., and Matera, R. H.: Anatomicopathological Considerations on 5 Cases of Associated Pulmonary Cancer and Tuberculosis (Consideraciones anátomo-patológicas sobre 5 casos de asociación de cáncer y tuberculosis pulmonar). *Rev. Asoc. méd. argent.*, 1940, 54: 713.

The authors state that in a recent work Frommel has reported 50 cases of primary cancer of the lung demonstrated anatomicopathologically, 8 of which were associated with pulmonary tuberculosis; 7 of these presented cancer and tuberculosis in the same lobe and 1 in the same lung. He showed that tuberculosis is not connected with the terminal cachexia of the cancer patient but precedes cancer by several years, and he concluded that tuberculosis is a precancerous disease, pointing out that in most cases cancer appears in torpid, non-evoluting tuberculous lesions. Others have drawn the same conclusion.

The authors have observed 30 cases of primary cancer of the lung, 5 of which presented at the same time a proved pulmonary tuberculosis. In 3 of the 5 cases, the two diseases were found to be associated in the left lung and lobe; the cancer was found in the right lung and the tuberculosis in the left lung in 1 of the remaining cases, and the cancer was found in the left lung and the tuberculosis in the right lung in the other case. Macroscopically, the following forms of cancer were observed: hilar in 2 cases, and nodular of the apex, lobular, and mediastinopulmonary in 1 case each. Histologically, the forms were typical cylindrical in 2 cases, atypical cylindrical in 1 case, and epidermoid of malpighian type in the 2 other cases. The tuberculosis presented the following forms: fibrocaseous in 3 cases, and exudative tuberculous bronchopneumonia, and cavernous and fibrous tuberculosis in 1 case each. Examination for tubercle bacilli after guinea-pig inoculation was positive for 1 case and repeatedly negative for the remaining 4 cases.

No extrapulmonary tuberculous lesions were found which would reveal a recent or an old tuberculous invasion in spite of the marked cachexia presented by the patients; this is in accord with the previously observed fact that the neoplastic cachexia does not promote the propagation of the tubercle bacillus. The association of the two diseases was not seen in the remote or the nearby metastases in any of the cases. In the patients in whom the association of the two diseases occurred in the same lung and lobule, the tuberculous lesions, in spite of their exudative type, did not present the active and progressive character proper to them, but the neoplasm always predominated clinically and anatomicopathologically. Finally, the authors think that the tuberculosis did not play any part in the cause of the carcinoma in their cases, but that each process evolved separately. RICHARD KEMEL, M.D.

HEART AND PERICARDIUM

King, E. S. J.: Artificial Collateral Circulation to the Heart; Some Critical Comments on Its Value. *Australian & New Zealand J. Surg.*, 1940, 10: 8.

Several methods have been suggested for dealing with the problem of myocardial disturbances resulting from coronary disease. One of the most important of these has been the attempt to produce a new circulation by way of adhesions induced between the heart and other structures. King presents a number of observations which have an important bearing on the problem.

The peculiar distribution in the heart of the affected muscle and, incidentally, of the scar tissue is considered very significant. These laminar areas or scars probably correspond to muscle planes or parts of them and usually lie in the deeper layers of the heart; that is, they are separated from the epicardial surface by a band of relatively normal myocardium. Their form, however, is the important feature, and this importance is independent of their relationship to anatomical layers.

In the majority of post-mortem specimens the principal evidence of previous ischemia is scar tissue found in three distributions: (1) in some cases, particularly recent occlusions of relatively large vessels, an area involving the whole thickness of the wall, but more or less localized to one zone, may be affected; (2) in others, the scar tissue has a laminar arrangement corresponding in distribution to the various heart muscle layers; and (3) in still other cases, a number of small, more or less discrete fibrous areas may be scattered throughout the myocardium.

Two types of lesion may be encountered: the type in which the ischemic tissue is on the surface, and that in which it is deeply situated and separated from the surface by an area of relatively normal myocardium. The passage of blood from one group of vessels to another depends upon a difference in intravascular pressure; thus, if the heart is normal such flow will not occur from grafts toward the heart; if the superficial layer of the heart is ischemic, blood may flow from an extracardiac structure to, and thereby supply, the heart muscle; and, if the affected

tissue lies deep in the heart wall, blood will not flow from an extracardiac structure to the superficial layer and cannot reach the affected tissue. Consequently, in many cases an artificial collateral circulation will not be effective.

King believes experimental work supporting the value of a surgically produced collateral circulation must be critically examined before its significance can be assessed. Clinical cases in which there is apparent improvement after operation have been observed, but King is convinced that such improvement is almost certainly due to factors other than the formation of a new circulation.

EARL GARSIDE, M.D.

Graham, E. A.: Aneurysm of the Ductus Arteriosus, with a Consideration of Its Importance to the Thoracic Surgeon; Report of 2 Cases. *Arch. Surg.*, 1940, 41: 324.

The author reports 2 cases of aneurysm of the ductus arteriosus which did not give evidence of aneurysm before operation. Although this is a rare condition it is probable that because of the great interest in thoracic tumors the condition will be encountered more frequently in the future than it has been in the past.

The possibility of an aneurysm of the ductus itself, or of the pulmonary artery developing as a complication of the patent ductus may be an argument in favor of surgical closure of recognized patent ductus.

The first patient was a man of thirty-one years who complained of a cough of several years' duration and recent hemoptysis. On x-ray examination a mediastinal tumor about 10 cm. in diameter projecting to the left of the aortic arch and filling the upper third of the left lung field was found. The aortic arch and trachea were dislocated to the right. There was a dense ring of calcification which practically surrounded the tumor. The roentgen diagnosis was mediastinal tumor (dermoid cyst with cardiac and tracheal dislocation).

The tumor was exposed by means of an anterior incision through the second, third, fourth, and fifth costal cartilages. It was firm and fixed. It could not be mobilized satisfactorily and, under the impression that the lesion was perhaps a malignant teratoma, it was incised. Marked hemorrhage occurred which was controlled only with difficulty. The heart stopped beating and was started again after cardiac massage, the intracardiac injection of adrenalin, and the transfusion of blood. Shortly after the chest was closed, however, the patient suddenly stopped breathing and the heart stopped beating. All efforts to revive him were unsuccessful.

Autopsy findings showed the right aortic arch with left subclavian artery as the last main vessel coming from the arch, aneurysm of the partially obliterated ductus arteriosus, and patent foramen ovale.

The tumor which was attached to the arch of the aorta was roughly spherical and measured 11 by 8 by 7.5 cm. It had a rubbery elastic feel and a

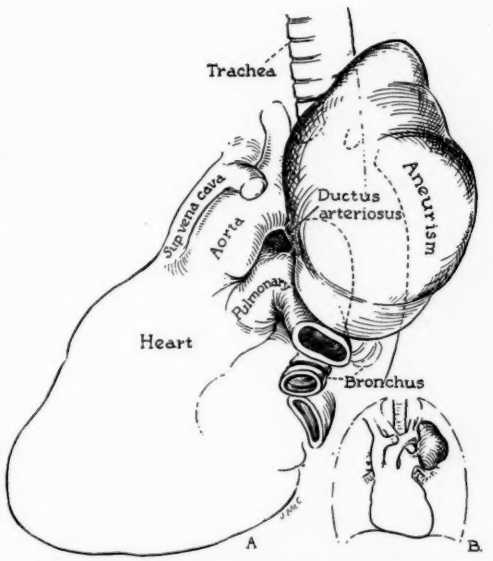


Fig. 1. Diagram reconstructed in Case 2 to show the mechanism of the position of aneurysms of the ductus arteriosus posterior to the trachea. The large drawing is a lateral view. The inset is an anteroposterior view. An aneurysm of the ductus pushes itself out between the pulmonary artery and the aorta to assume a left lateral and posterior position.

covering which was formed of a thin plate of irregularly calcified tissue. Posteriorly and medially the tumor rested on the bodies of the upper thoracic vertebræ which were eroded by the pressure from the tumor. An opening 2 cm. in diameter on the lesser curvature of the aorta communicated with the tumor. On the anterior superior surface of the pulmonary artery was a small partially obliterated stump of the ductus arteriosus which had been severed at operation or autopsy. This communicated with the tumor directly.

The second patient was a man of twenty-seven who complained of wheezing spells, shortness of breath, and cough on exertion. The symptoms were said to have followed an automobile accident seven years previously at which time he sustained a blow on the chest.

X-ray studies showed a rounded, pedunculated tumor at the level of the pulmonary conus, anterior to the spine and posterior to the trachea. Pulsation was thought to be transmitted rather than expansile.

Pre-operatively, the diagnosis was tumor of the posterior mediastinum, perhaps neurofibroma.

At operation a tumor the size of an orange was found wedged between the aorta and the pulmonary artery. The mass seemed to pulsate and blood was readily aspirated from it. No further dissection was done for fear of rupturing the sac (Fig. 1).

The most important diagnostic feature is the location of the tumor in the superior mediastinum in the region of the pulmonary conus, posterior to the trachea. Other varieties of mediastinal tumors seldom are found in this location. On the basis of probability one should suspect a tumor in this region of being an aneurysm of the ductus arteriosus. Recognizable expansile pulsation and abnormal heart sounds need not be present. The fact that neither case gave any evidence of disturbance of the recurrent laryngeal nerve is remarkable. The author predicts that some day an aneurysm of the ductus arteriosus small enough to be removed may be encountered. JOHN A. GIUS, M.D.

MISCELLANEOUS

Bloomfield, A. L.: Dysphagia with Disorders of the Heart and Great Vessels. *Am. J. M. Sc.*, 1940, 200: 289.

Dysphagia may occur in connection with the following disorders of the heart and aorta: dilated left auricle, pericarditis, saccular aneurysm, dissecting aneurysm, and anomalous aortic arch. Pressure on, and compression of the esophagus occurs frequently in the above conditions, yet dysphagia is relatively uncommon except with saccular aneurysm or anomalous aortic arch.

The author presents a case of dysphagia associated with compression of the esophagus by an enlarged left auricle in detail. The anatomical relations resulting in this condition are nicely illustrated.

He reviews the literature on dysphagia associated with cardiac disorders and makes the following pertinent observations:

1. Difficulty in swallowing with pericarditis suggests a large pericardial effusion.

2. Marked dysphagia with aneurysm suggests a false sac or a huge lesion threatening rupture.

3. Dysphagia in a supposed case of coronary occlusion should arouse suspicion of a dissecting aneurysm. LUTHER H. WOLFF, M.D.

Adams, R.: Evaluation of Pulmonary Function Tests in the Determination of Risk Prior to Thoracic Surgery. *J. Thoracic Surg.*, 1940, 9: 623.

There are so many factors that influence the vital capacity of an individual that the determination of vital capacity is of little help in estimating the operative risk of patients with pulmonary disease.

Analysis of the oxygen and carbon dioxide in the blood are too burdensome to be of practical clinical benefit.

Bronchoscopic spirometry is the simultaneous volumetric measurement and gas analysis of respiratory air from each lung separately. It gives considerable accurate information as to the function of each lung, but is very trying on the patient. It has only a limited clinical application in the determination of the function of each lung in which an irreversible collapse operation is contemplated.

Determinations of the venous pressure have not been made extensively and have not proved to be adequate for testing pulmonary function.

Electrocardiography has the same prognostic importance in lung surgery that it has in surgery of any other region.

The author concludes that we have no simple functional tests that are very helpful in determining the operative risks of patients with thoracic disease. The surgeon must rather depend on careful physical examinations and observations of the patient to determine the operative risk. His clinical experience is his best guide. JULIAN A. MOORE, M.D.

SURGERY OF THE ABDOMEN

ABDOMINAL WALL AND PERITONEUM

Zieman, S. A.: Fallacy of the Conjoined Tendon. The Etiology and Repair of Inguinal Hernia. *Am. J. Surg.*, 1940, 50: 17.

The author made a careful anatomical study of the inguinal regions of 20 presumably normal cadavers and found the conjoined tendon discernible as a distinct structure in only 2 specimens. This frequent absence of the structure is due to the fact that the tendinous portion of the transversus abdominis is often absent and does not join that of the internal oblique to form a conjoined tendon. The etiology of inguinal hernia is not, then, primarily a defective conjoined tendon, and the most important step in repair is not that of suturing this tendon to the inguinal ligament.

The author thinks that the transversalis fascia is a more constant and important structure than the transversus abdominis muscle or the conjoined ten-

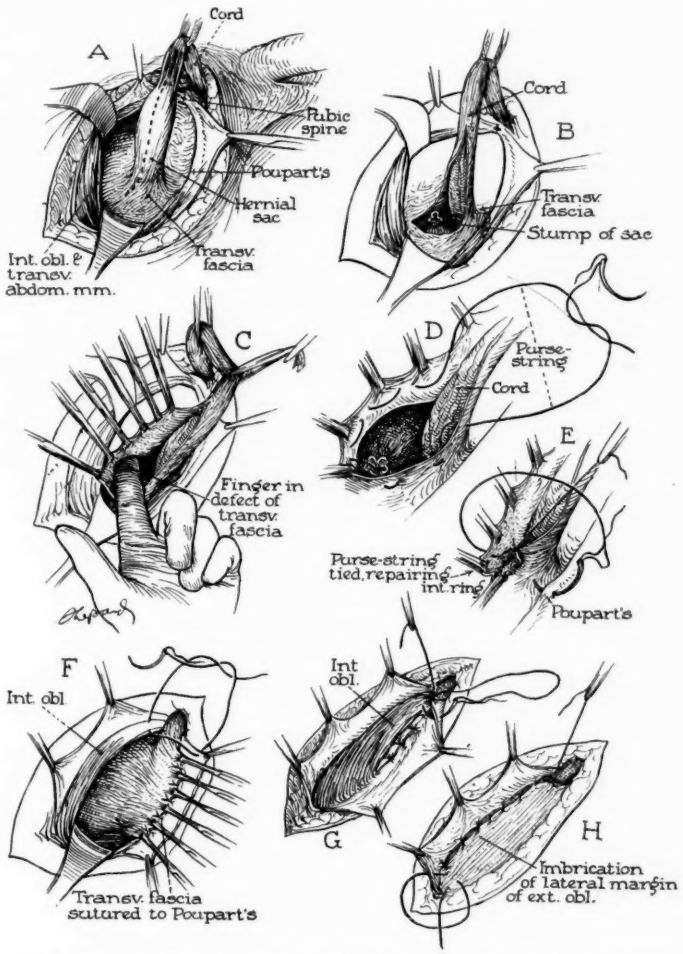


Fig. 1. Successive steps in author's method of repair for indirect inguinal hernia. (Courtesy of J. B. Lippincott Co.)

don, and that a defect in this structure is the usual etiological factor in inguinal hernia, whether direct or indirect. On these grounds he describes a method of repair of indirect inguinal hernia, the most important step of which is suturing this defect in the transversalis fascia with a purse-string suture. The repair is completed by imbricating the remaining layers (Fig. 1). RICHARD WARREN, M.D.

GASTRO-INTESTINAL TRACT

Wangensteen, O. H., Varco, R. L., Hay, L., Walpole, S., and Trach, B.: Gastric Acidity Before and After Operative Procedure, with Special Reference to the Rôle of the Pylorus and Antrum. *Ann. Surg.*, 1940, 112: 626.

This study is an effort to assay the effects of gastro-enterostomy, antral excision, extensive gastric resection, tubular resection with and without gastro-enterostomy, and the Schmilinsky operation on gastric acidity and gastric evacuation. The gastric acidity, gastric emptying time, gastric evacuation time, and the amount of stomach removed were recorded in 60 patients, pre-operatively and post-operatively.

In 29 cases of gastro-enterostomy the reduction in gastric acidity was slight and no patient was achlorhydric to histamine. The emptying and evacuation time was short, which probably explained the temporary good results after gastro-enterostomy.

Of the 6 cases of excision of the antrum and pylorus, all operated on for massive hemorrhage, none developed achlorhydria to histamine; 2 developed gastro-jejunal ulcer.

In 10 cases extensive gastric resection with removal of the antrum and pylorus was done and all were achlorhydric to histamine at some time or other, the emptying times were rapid, and no gastro-jejunal ulcers developed.

Extensive gastric resection with exclusion of the antrum was done in 6 cases, but with the exception of 2 which were achlorhydric to normal doses of histamine, they were not suitable for study because the operations were too recent.

The Schmilinsky operation, which provides for total intragastric regurgitation of bile and pancreatic juice, was performed in 3 cases. One patient is doing quite well, although the emptying time is slow, and the 2 others died of acute postoperative ulcers, one from hemorrhage and the other from perforation. The conclusion is that this is a poor operation.

Eight tubular excisions of the corpus and fundus with or without gastro-enterostomy were performed. Those patients who underwent gastro-enterostomy are achlorhydric to histamine, those who did not are not, but all are well.

On the basis of the studies on the amount of gastric tissue which must be removed to produce achlorhydria, it is stated that from 66 to 80 per cent must be taken. The authors believe that the failure of the Schmilinsky operation may be due to the fact that total regurgitation of bile stimulates the gastric phase of secretion and so increases the acidity. They believe that entero-enterostomy in conjunction with high gastric resection may diminish such regurgitation and therefore be beneficial. In the supine position there is 33 per cent regurgitation through a gastro-enterostomy stoma, as shown by x-rays. The authors state that in general the occurrence of jejunal ulcer is from 5 to 10 per cent.

Experimental work on animals attempting to put to a test Edkins' hypothesis of the gastric phase of gastric secretion is reported. Most experiments showed that antral excision had no effect on the acid secretion in the fundal pouches of dogs. This suggests that Edkins' hypothesis is invalid. This conclusion is supported by the clinical evidence of cases of tubular resection that become achlorhydric with the antrum intact as well as by those which have antral excision and do not develop achlorhydria.

RICHARD WARREN, M.D.

Chasnoff, J., Leibowitz, S., and Schwartz, R.: An Evaluation of the Meulengracht Régime in the Treatment of Bleeding Peptic Ulcer. *Am. J. Digest. Dis.*, 1940, 7: 373.

Important mortality reports in the literature on the medical therapy of bleeding peptic ulcer have been tabulated by the authors and found to vary from 4.3 per cent to 32.7 per cent. These findings are compared to Meulengracht's mortality of 1 per cent following his method of treatment. Meulengracht used a diet high in calories, containing bread, butter, tea, oatmeal, milk, various meats, fish, mashed potatoes, puréed vegetables, stewed fruit, and cocoa. This was given at three-hour intervals immediately after hospitalization.

The authors treated 21 patients by a similar routine and contrasted the results obtained to those obtained in the control group of 72 patients with bleeding peptic ulcer treated with the older medical method. The mortality for the Meulengracht group was 4.76 per cent. The mortality in the control group was 11.1 per cent. They confirmed Meulengracht's findings that patients receiving early liberal feedings manifest a "well-being" not present under the older method of therapy. The time of hospitalization was, however, not decreased by the Meulengracht regimen. In addition, 2 of the 21 cases, or 9.5 per cent, were complicated by perforation, whereas only 1 patient of the control group, 1.4 per cent, had a perforation. The possible rôle played by the increased feedings in the greater incidence of perforation merits consideration.

SAMUEL J. FOGELSON, M.D.

McClure, R. D., and Fallis, L. S.: Partial Gastrectomy for Peptic Ulcer. *Surgery*, 1940, 8: 575.

The authors present a clinical and follow-up study of 74 cases of partial gastrectomy for peptic ulcer (including 5 cases diagnosed pathologically as cancer), performed in the five-year period from 1934 to 1939. They believe this operation to be the one

choice in cases of peptic ulcer coming to elective surgery because of the low mortality and the satisfactory results.

In the authors' cases the age range was from twenty-two to sixty-seven years and the ratio of males to females 9 to 1. According to the pathological data there were 47 duodenal and 22 gastric ulcers. There were 5 marginal, gastro-jejunal, or jejunal ulcers. The average duration of symptoms before operation was seven and one-half years. Definite indications for operation were (1) cicatricial pyloric obstruction, (2) perforation, usually into the head of the pancreas, (3) persisting acute hemorrhage, (4) a history of recurrent hemorrhages, (5) suspected malignancy of gastric ulcer, (6) a gastro-jejunal ulcer, and (7) recurrent activity after comprehensive and adequate medical treatment. Relative indications for operation were (1) a poor economic status which made adequate medical treatment difficult, (2) a poor intelligence quotient causing inability to follow the medical regimen, and (3) the major type of nervous problem interfering with successful medical treatment.

The types of operation were as follows: Polya (60); Finsterer (7), Billroth II (5), unknown (1), and sleeve resection (1). There were 4 deaths, all from peritonitis, 2 of them due to leakage of the duodenal stump, 1 to injury to the common bile duct, and 1 to kinking of the jejunum proximal to the stoma.

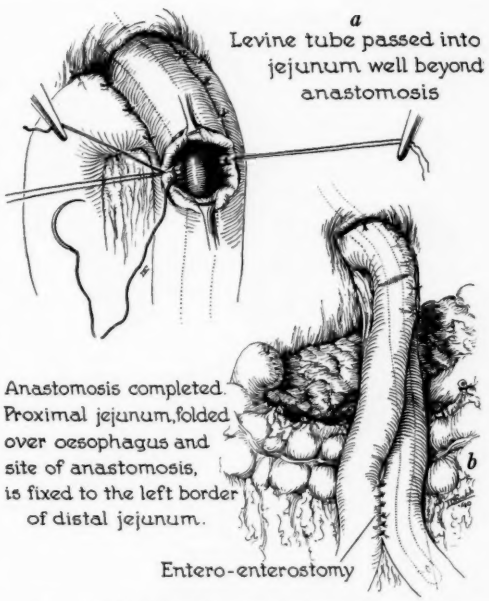
The follow-up statistics, which are not final because 31.4 per cent of them are of less than six months' duration, show excellent results in 48.6 per cent of the cases; good in 30 per cent, fair in 4.2 per cent, poor in 8.6 per cent, and unclassified results in 8.6 per cent. RICHARD WARREN, M.D.

Graham, R. R.: A Technique for Total Gastrectomy. *Surgery*, 1940, 8: 257.

Many physicians and a few surgeons believe that the operation of total gastrectomy is a very questionable procedure. This belief is due to the very high immediate mortality directly attributable to the operation. In addition, most of the surviving patients ultimately die from metastases from the primary growth. The dietetic restrictions which most patients must observe may be incompatible with happiness and freedom from gastro-intestinal discomfort. The first two objections are valid. The third is debatable.

The enthusiasm which the individual surgeon displays for this operative procedure must depend largely upon his philosophy of life. If such philosophy demands that all efforts be used to prolong life, even though the effort be accompanied by grave immediate risk, and though the patient will ultimately die from carcinoma, provided he live long enough, then such a surgeon must be an advocate of total gastrectomy.

The author's experience with total gastrectomy in 19 cases represents efforts to restore continuity between the esophagus and the rest of the gastro-intestinal tract by many combinations and permutations of anastomoses between the stomach, duodenum, and jejunum. The mortality until recently has been due almost entirely to the technical difficulty of securing a satisfactory anastomosis between the esophagus and jejunum. The technique presented here has been carried out in 6 cases, and in none of these has the primary cause of the still appalling mortality been due to the esophagojejunal anastomosis. Only 1 patient in this group of 6 is still alive and well nineteen months after operation. Of the remaining 13 who underwent total gastrectomy, 4 survived. This mortality does not make the author proud of his results, but it is presented to show the tenacity of purpose which was due to the firm belief that every effort should be made to extirpate a gastric carcinoma, which if left *in situ*, would inevitably be fatal. In 7 of the 19 cases, or 36.8 per cent,


a
Levine tube passed into jejunum well beyond anastomosis
Anastomosis completed. Proximal jejunum folded over oesophagus and site of anastomosis, is fixed to the left border of distal jejunum.
b
Entero-enterostomy

Figs. 1 *a* and *b*. When the posterior layer of mucous membrane sutures is completed, the Levine tube is passed down farther into the distal jejunum well past the esophagojejunal anastomosis and the anterior layers of the anastomosis are completed. The proximal jejunum is then folded over the front of the esophagus and the esophagojejunal anastomosis and united to the lateral margin of the distal limb of the jejunum. By this maneuver the esophagus and the esophagojejunal anastomosis are completely encircled by the jejunal loops. This contact of peritoneum to peritoneum ensures healing to a greater degree than the contact of the bare esophagus to the jejunum. This maneuver completely obstructs the proximal jejunal loop and makes an entero-anastomosis necessary. During this anastomosis the Levine tube is passed farther down into the distal jejunum to make possible direct jejunal feeding early in the patient's convalescence.

there was no evidence of extension of the disease beyond the stomach.

The details of the operative procedure are as follows:

The abdomen is opened by displacing the upper right rectus muscle laterally by a right paramedian incision. One must be certain that there is no extension of the carcinoma into the liver or lymph glands, which would render complete removal impossible. If the disease is limited to the stomach and adjacent lymph nodes, then adequate exposure is essential. Transverse division of the left abdominal wall midway between the ensiform process and the umbilicus is a great asset. The left lobe of the liver is next mobilized which adequately exposes the entrance of the esophagus through the diaphragm. The greater and lesser curvatures of the stomach are mobilized and the duodenum is divided just distal to the pylorus. The closure of the duodenal stump demands meticulous care. When the stomach is freed from the duodenum, it is wrapped in gauze tied with heavy tape. By downward traction, the stomach being used as a lever, the finger is inserted between the esophagus and the opening of the diaphragm. This will permit mobilization of the esophagus to a surprising degree, while additional blunt gauze dissection will make it possible to draw down the esophagus a further 2 in. below the opening in the diaphragm. Next, the jejunum is sutured to the under surface of the diaphragm by interrupted sutures after the suggestion of Allen. A point in the jejunum about 18 in. from the duodenojejunal flexure is selected and the jejunum is brought up in front of the transverse colon to be fixed to the diaphragm. The procedure advocated by Allen adequately fixes the jejunum and prevents the weight of jejunal contents from being a factor in creating tension on the new esophagojejunal anastomosis. With the jejunum firmly anchored to the diaphragm, the infradiaphragmatic portion of the esophagus is then fixed by means of interrupted sutures to the anterior surface of the distal limb of the jejunum. Usually three or four of such sutures on either side are sufficient, the most distal suture on both sides being held in hemostats to act as guy sutures. The esophagus may then be divided, great care being taken to keep up continuous suction with a Levine tube which has been passed into the stomach before operation. The Levine tube is now withdrawn to a point in the esophagus just proximal to the line of division. Interrupted sutures unite the posterior wall of the esophagus to the anterior wall of the jejunum. The esophagus is next divided and the jejunum opened. After the posterior layer of the anastomotic suture has been completed, the Levine tube is passed down into the distal jejunum. The anterior layers of the anastomosis are completed in the usual manner, which makes a very satisfactory end-to-side stoma between the lower cut end of the esophagus and the anterior wall of the distal limb of the jejunum.

When the anastomosis is completed, the proximal jejunal loop is then rolled laterally across the esophagus and sutured to the left lateral margin of the distal limb of the jejunum. This completely surrounds the infradiaphragmatic portion of the esophagus with the jejunal loops, and very firmly covers and supports the end-to-side jejuno-esophageal anastomosis as indicated in Figure 1a. Since this maneuver completely obstructs the proximal jejunal loop, an entero-enterostomy must be carried out between the proximal and distal jejunal loops. The Levine tube is passed on into the distal limb of the jejunum beyond the entero-enterostomy. The abdominal wall is closed in layers without drainage. The interrupted sutures employed are silk sutures although catgut may be used.

During the operation, a blood transfusion of 500 c.cm. is given. The fluid balance is maintained by the intravenous administration of 5 per cent glucose in 1,500 c.cm. of saline solution and a second infusion of 1,500 c.cm. of 5 per cent glucose in distilled water twice in the twenty-four hours. The patient sucks ice chips. No fluid or food is given by mouth. The oral cavity is sprayed with liquid paraffin. After twenty-four hours 10 per cent glucose in saline solution can be introduced into the jejunum through the Levine tube by the drip method at the rate of 125 c.cm. per hour. At the end of forty-eight hours, the type of tube feeding and management as advocated in the treatment of gastric ulcers is applicable here. JOHN W. NUZUM, M.D.

Fine, J., Hurwitz, A., and Mark, J.: A Clinical Study of the Plasma Volume in Acute Intestinal Obstruction. *Ann. Surg.*, 1940, 112: 546.

In experiments on animals with uncomplicated obstruction of the small intestine a fall in the volume of the circulating plasma sufficient to account for death has been observed. The evidence is clear that this loss of plasma may occur in the absence of dehydration or the accumulation of significant quantities of fluid in the cavity or wall of the intestine or in the peritoneal cavity. While the administration of large quantities of fluids and electrolytes does not halt the loss of plasma, the injection of a small or smaller amount of plasma not only maintains the plasma volume but prolongs the life of the animal. Decompression of the intestine halts the loss of plasma volume and may permit a substantial recovery of the fraction lost. Distention of the colon and gall bladder does not cause a significant plasma loss while distention of two feet of small intestine may do so.

Nine cases are presented which demonstrate clinically the truth of the above assertions. Obstruction of either a mechanical or paralytic type resulted in marked loss of the circulating plasma volume. In 8 cases presenting ileus of the small intestine, the average loss of plasma was 27.4 per cent, whereas in 1 case of obstruction of the large bowel, there was practically no loss at all. Moreover, the amount of loss was roughly proportionate to the distention, as estimated roentgenographically and by physical examination.

At the present time the plasma loss cannot be accounted for on the basis of fluid or electrolyte imbalance or on the basis of effects directly referable to the site of the obstruction, and therefore we are obliged to assume the existence of some other process as yet undiscovered, which is set in motion by the increase in intra-intestinal pressure.

JOHN WILTSIE EPTON, M.D.

Besser, E. L.: The Cause of Death in Cases of Mechanical Intestinal Obstruction; Consideration of Certain Confused Issues and a Review of the Recent Literature. *Arch. Surg.*, 1940, 41: 970.

A survey of the tremendous amount of literature on the cause of death in cases of intestinal obstruction results in a confusing picture in which conflicting opinions present themselves concerning many phases of the problem. This fact led the author to write the present article, in which he gives a careful résumé of the experimental studies carried out since Cooper's review of the subject in 1928.

The author points out that in most instances of clinical obstruction and in the various types of experimental obstruction, death occurs before gross perforation of the intestine has taken place, and under these circumstances the cause of death cannot be satisfactorily explained by the autopsy findings. For many years it was generally believed that the cause of death from all types of obstruction was "toxemia," that is the absorption of some toxic substance from the gastro-intestinal tract. Recent studies, however, indicate that in different types of obstruction different mechanisms may operate to cause death—different physiological and pathological alterations take place.

In case of high obstruction the preponderance of evidence tends to indicate that death is due to the loss to the body of the secretions of the upper part of the intestine, the essential constituents being water and sodium chloride. While there is as yet no universal acceptance of this concept, it is supported by the extensive experiments of most recent investigators. Thus, the fact that life can be markedly prolonged by the replacement of sufficient amounts of water and sodium chloride, and only these substances, substantiates this contention. Moreover, recent experiments in which the intestinal secretions were shortcircuited around the obstruction likewise uphold this contention.

In cases of low intestinal obstruction the opportunity for reabsorption is present. While dehydration and electrolytic loss may account for death in some instances, these factors do not seem adequate to explain death in the majority of cases. Here the general consensus is that death is due to the absorption of toxic materials. There is some experimental evidence that abnormal absorption occurs in the presence of obstruction, but the relation between the intoxication and the mucosal changes is not definitely established. Thus, many investigators contend that toxic absorption does not take place until there are definite microscopic changes in the intestinal mucosa, while others believe that selective absorption of the mucosa may be changed before any pathological change becomes visible. Recent studies indicate that death in cases of low ileal obstruction occurred in the absence of marked changes in the intestinal mucosa. Dehydration and electrolyte loss may have been a factor in those instances in which mucosal changes were not evident; however, this has not been definitely established. Most experiments tend to show that no transperitoneal absorption of the intestinal wall takes place as long as it is viable. With increased intra-intestinal pressure there appears to be a decrease in absorption of substances normally absorbed by the intestine and pressure has not been shown to cause absorption of most substances that are not normally absorbed.

It is true that lymphatic absorption is increased in cases of intestinal obstruction, and certain substances are absorbed through the lymphatics that are not absorbed by the normal tissue. There is no conclusive proof, however, that absorption of a lethally toxic material occurs in this manner.

In general there is no satisfactorily substantiated evidence of toxic materials in the body fluids in cases of low ileal obstruction. Experimental animals with low ileal obstruction die in a state of "shock." While there is a decrease in blood and plasma volume which certainly is of some consequence, yet the precise rôle that this factor plays is not definitely known. Although the nature and origin of the toxic material in obstructed contents are not clear, the preponderance of evidence suggests that the toxicity of this material is dependent on bacterial activity, and, although multiple toxins may be involved, part of the toxicity seems to be caused by the presence of histamine or a closely allied substance.

MATHIAS J. SEIFERT, M.D.

Wangensteen, O. H.: The Problem of Surgical Arrest of Massive Hemorrhage in Duodenal Ulcer. *Surgery*, 1940, 8: 275.

Massive hemorrhage is a not uncommon cause of death in duodenal ulcer. Approximately 10 per cent of patients treated conservatively for massive hemorrhage of ulcer origin die. The lives of a number of such patients may be saved by timely surgical intervention. The recovery of 5 of 7 patients subjected to ante-mortem operation for the control of hemorrhage suggests, in the main, that such patients stand operation tolerably well if the bleeding is adequately controlled. A means of uncovering the bleeding point, dealing with the open vessel, and a manner of securing satisfactory closure of the duodenum are described.

It is pointed out that a fall of the blood pressure to a shock level, necessitating transfusion of large quantities of blood to maintain the pressure at 100 mm. Hg, suggests that the patient has an open vessel. In massive hemorrhage from duodenal ulcer the gastroduodenal artery is eroded, because of per-

foration of the posterior duodenal wall. The ulcer itself is often occult, presenting usually even at operation during active hemorrhage no tangible signs until the perforation is uncovered. Patients with duodenal ulcer who bleed slowly to low levels of hemoglobin (from 20 to 40) without manifesting significant falls in the blood pressure do not exhibit complete perforation of the duodenal wall nor do they have a hole in a large vessel; they usually present erosion of the small vessels within the bowel wall.

The most difficult question to decide is when operation should be undertaken. No one can say in which patients bleeding will cease automatically. The longer the bleeding period before operation, the more serious the risk. The patient with massive hemorrhage who bleeds to shock level, and in whom it is difficult to maintain satisfactory blood pressure should be submitted to immediate operation, as soon as the blood loss is replaced adequately. In other patients Finsterer's dictum of waiting forty-eight hours to determine whether bleeding will cease spontaneously is sound advice. However, until the hazards of massive hemorrhage become known more generally, it is not likely that patients with threatening hemorrhage will come to operation early.

JACOB M. MORA, M.D.

Miller, E. M., Fell, E. H., Brock, C., and Todd, M. C.: Acute Appendicitis in Children. *J. Am. M. Ass.*, 1940, 115: 1239.

The authors report a clinical study of 1,163 cases of acute appendicitis and its common complications, observed in the Children's Surgical Ward of Cook County Hospital, Chicago, during a period of six years.

All patients with acute appendicitis and its common complications, whether children or adults, are classified in one of three groups.

Group 1 comprises all patients with acute unperforated appendicitis. Immediate appendectomy is the only treatment indicated in all cases of this type, unless the attack is obviously subsiding. Immediate operation upon 629 patients was associated with no deaths, and none of these patients was treated conservatively.

Group 2 includes all patients with the clinical characteristics of an appendical abscess. These patients have usually been ill for several days. They have moderate fever and marked leucocytosis, but they are not desperately ill. There is a palpable abdominal mass which, regardless of its size or position, represents pathologically a slow leak from the appendix that has allowed sufficient time for the body defense processes to wall it off from the general peritoneal cavity. These patients should be treated conservatively. Twenty-five patients of this type were operated upon for drainage, with a mortality of 8 per cent. Two hundred and three patients were treated conservatively, with a mortality of 2.5 per cent. In all but a few cases careful observation will reveal a gradual improvement in the clinical picture and a progressive diminution in the size of the abdominal mass, until at the end of from four to five weeks it is no longer palpable. These patients should return to the hospital in approximately three months for appendectomy. Very few cases will exhibit progressive aggravation of symptoms and enlargement of the mass; in these the mass will usually point at some place where it can be easily and safely drained.

Group 3 includes patients who have spreading peritonitis. These patients are very sick. The abdomen is distended and tense, and there is generalized tenderness. The appendix has perforated into the general peritoneal cavity too suddenly for the establishment of an adequate defense. Many of these perforations result from the obstructive type of appendicitis.

Patients in this last group should be operated upon immediately, allowing only time for adequate preparation by the correction of fluid and electrolyte inbalance, relief of distention, and the replacement of the lost plasma protein. In the cases of 281 patients treated in this manner the mortality was 12.8 per cent. Twenty-five were treated conservatively, with a mortality of 80 per cent.

The technique of the authors' operative procedure for patients with peritonitis is briefly described. The McBurney incision is almost always employed. Cultures of the free pus are made when the peritoneal cavity is opened. The Poole suction tip is used instead of gauze sponges. The perforated appendix is delivered with a Babcock forceps. The stump is always ligated with catgut and, if possible, is inverted with a catgut pursestring suture. Drains of the soft cigarette type are placed as near to the source of infection as possible. Judicious postoperative treatment attempts to restore to the circulating blood all elements that have been depleted by the infectious process.

EDWARD W. GIBBS, M.D.

Barrow, W., and Ochsner, A.: The Treatment of Appendical Peritonitis. *J. Am. M. Ass.*, 1940, 115: 1246.

A scientific study of 1,039 New Orleans Charity Hospital patients with acute appendicitis led the authors to formulate the following definite principles:

The problems of acute appendicitis are the prevention and treatment of appendical peritonitis.

Prompt removal of an inflamed appendix before perforation has occurred is imperative.

There is no conservative treatment of acute appendicitis without perforation.

Procrastination and catharsis are the greatest factors in causing perforation and death.

Operative intervention is the treatment of choice for patients with suspected appendical peritonitis, even when the diagnosis cannot be established with reasonable certainty.

Less harm is done by incision through the abdominal wall of a patient with appendical peritonitis than by omission of such a procedure in the presence

of intestinal obstruction or a small, slowly leaking, perforated peptic ulcer.

An appendix should not be removed in case of appendical peritonitis if adhesions must be broken down, and especially not if the process is walled off. The only exception to this rule is if the appendix lies immediately beneath the incision, is not adherent to surrounding structures, or presents a gross perforation at its base through which intestinal contents continue to leak.

The ultimate outcome of appendical peritonitis depends upon the conflict between the patient's infection and his defensive powers.

If there is doubt about perforation, exploration should be done. The majority of patients with generalized appendical peritonitis exhibit generalized abdominal pain, absence of peristalsis on auscultation, rebound tenderness referred to the point of palpation of the left side of the abdomen, tenderness on both sides on rectal or vaginal examination, and distention—the absence of peristalsis and abdominal distention are the most reliable points of diagnosis. Occasionally, in cases of twenty-four hours' duration one or more of these symptoms may be absent after localization has begun; and, conversely, a patient whose appendix has not ruptured may present problems suggestive of appendical peritonitis. Therefore, without exception, an acutely inflamed appendix entering the hospital within the twenty-four-hour period was removed regardless of clinical signs of perforation or generalized peritonitis. When perforation occurs in the twenty-four-hour period, the defensive mechanism is too poorly organized to cope with infection. After from seventy-two to ninety-six hours these perforations are usually largely sealed by omentum or surrounding intestines.

Conservative treatment has its place, if properly carried out.

The patient must be kept quietly in bed to favor localizing processes. Too many and too vigorous manipulations and examinations may be disastrous. Elevation of the head end of the bed will favor localization of secondary abscesses, if any, in the pelvis where they can be detected and drained easily. Absolutely nothing should be given by mouth. Distention is minimized by inhalation of concentrated oxygen and by constant gastric suction of the type advocated by Wangensteen. Decompression of the small bowel by means of the double tube suggested by Miller and Abbott is of great value—especially adynamic ileus can be combated satisfactorily by its use together with continuous suction. Intragastric suction is also used to prevent the accumulation of fluid in a poorly functioning gastro-intestinal tract.

Morphine sulfate (1/6 gr.) is given every three hours unless respirations are less than 14 per minute; this is an aid because of its tonic action on the intestine and sedative action on the patient. Fluid-salt balance is maintained by intravenous infusion twice daily. Adrenocortex extract is of inestimable value in combating the toxemia and aiding maintenance of the electrolyte balance. Multiple small transfusions help to combat anemia and hypoproteinemia. Recently the authors have come to believe that sulfanilamide in an 0.8 per cent subcutaneous infusion is of value in the treatment of appendical peritonitis. Appropriate treatment of secondary intraperitoneal abscesses is an important part of the conservative treatment.

A critical review of results obtained in appendicitis in different large municipal hospitals of the West Coast, the Middle West, and the South Central States revealed that they were practically the same as the authors'.

The authors give the following summary:

Among 860 patients with uncomplicated acute appendicitis the mortality was 0.8 per cent; among 179 patients with acute appendical peritonitis it was 27.3 per cent.

Of 15 patients with appendical peritonitis seen within twenty-four hours after the onset, 12 had prompt appendectomies with 3 deaths; 2 of the 3 treated conservatively also died.

Of 92 patients with appendical peritonitis seen from twenty-four to seventy-two hours after the onset, 61 had immediate operations with 15 deaths; 5 of the 31 treated conservatively died.

Of 62 patients with appendical peritonitis seen three days after onset, 21 had immediate appendectomies with 10 deaths; 3 of the 41 treated conservatively died.

The authors believe that exploratory laparotomy is the best procedure when the diagnosis of acute appendicitis is not reasonably certain, when there is doubt about perforation, and when the cases are seen within twenty-four hours of the onset of symptoms.

MATHIAS J. SEIFERT, M.D.

Arnheim, E. E.: Diverticulitis of the Colon, with Special Reference to the Surgical Complications. *Ann. Surg.*, 1940, 112: 352.

The complications of diverticulitis of the colon requiring surgery are listed as follows: (1) peritonitis resulting from the passage of organisms through inflamed diverticula without perforation; (2) perforation of inflamed diverticula with peritonitis or abscess; (3) fistula formation, including fistulas between the colon and abdominal wall, colon and bladder, or colon and another portion of the intestine; (4) peridiverticulitis, resulting in thickening of the colon, tumor-like formation, and narrowing of the lumen of the intestine; (5) metastatic suppuration; and (6) carcinoma arising from diverticula of the colon.

In 19 of 35 cases of diverticulitis of the colon admitted to Mount Sinai Hospital, New York, between 1927 and 1937, surgical complications were present. The 16 uncomplicated cases were apparently cured by medical management. Peritonitis without perforation was present in 2 cases, perforation with abscess in 5 cases, perforation with peritonitis in 5 cases, peridiverticulitis (stenosis) in 4 cases, sigmoidovesical fistula in 2 cases, and associated carcinoma in 1 case. The average age of the patients

presenting complicated cases was fifty-one years, while the age of those presenting uncomplicated cases was sixty-nine years. A case of diverticulitis of the colon in an eighteen-hour-old infant is among those reported, this being the youngest patient on record.

The sigmoid was the most frequent site of disease, but in 2 cases there was a perforation of a diverticulum of the splenic flexure of the colon. The operative mortality in the cases with surgical complications was 62 per cent. This group included 4 patients who were either too seriously ill to warrant operative interference or who refused surgery. Most of the deaths were due to peritonitis which was far advanced at the time of operation. One patient died after being subjected to surgery without adequate pre-operative therapy. Two patients died following resection with primary end-to-end anastomosis. HAROLD LAUFMAN, M.D.

Finochietto, R., and Esperne, P.: Anal Sphincter; Plastic Operation for Partial Incontinence (Esfinter anal; plástica por incontinencia parcial). *Arch. argent. de enferm. d. apar. digest.*, 1940, 15: 500.

The external anal sphincter consists of three superimposed and somewhat telescoped rings of striped muscle fibers which form a truncated cone, the base of which rests on the levator muscle of the anus. The external ring, or subcutaneous bundle, is the thinnest; the middle ring, or superficial bundle, is thicker; and the internal ring is a real muscle of good size and ample base, the external part of which fuses with the fibers of the levator muscle of the anus. The truncated cone is hollow and contains a thick tube of circular unstriped muscle fibers which constitute the internal anal sphincter and are

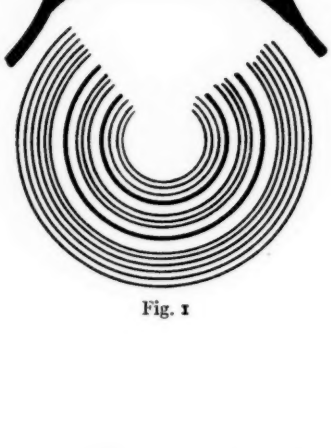


Fig. 1

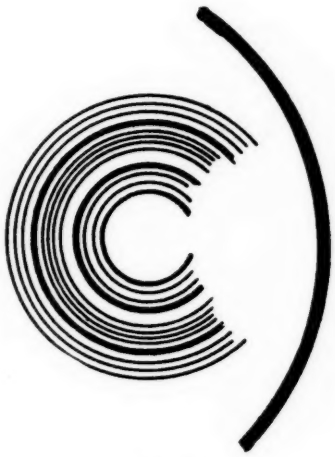


Fig. 2

the continuation of the internal circular muscle layer of the rectum.

When the sphincter is completely cut in the treatment of anal fistula, it retracts immediately but not to the same extent in its various parts: the subcutaneous bundle being free retracts more, while the superficial and deep bundles retract less because they adhere to the neighboring tissues; the fibers of the internal sphincter retract most. In unfavorable cases, the process of healing will form a bridge of fibrous tissue which will keep the extremities of the sectioned muscles separated; repair will be especially difficult in cases in which the intervention has taken place in the lateral quadrants where vessels and nerves have been sectioned. The worst cases are those in which portions of muscle have been excised.

Incontinence may be total or partial; the latter is the more frequent and is the only type considered in this study. The treatment consists of liberation of the muscular stumps and their suture under the

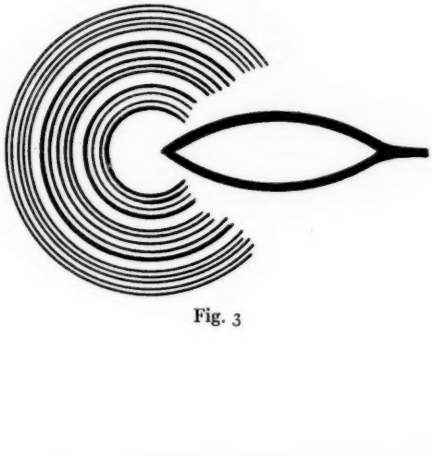


Fig. 3

best possible aseptic conditions, the asepsis being the greatest difficulty of the intervention. Three basic types of incision are used: the H-form (Fig. 1), which is extramucosal, provides a good field, and is useful when the anterior or posterior raphe is involved; the semilunar (Fig. 2), which is also extramucosal and serves for lateral interventions; and the elongated oval (Fig. 3), which reaches the anal canal and is indicated in cases of great separation of the stumps.

Four cases are described. Careful hemostasis is indicated after each step in the operation. The stumps of the individual muscle bundles are sutured with chromicized catgut, No. 0, after they have been sufficiently liberated to avoid tension on the sutures. The skin sutures may be removed on the fourth or fifth day. RICHARD KEMEL, M.D.

Garat, J. A.: Surgical Treatment of Anorectal Fistulas (Tratamiento quirúrgico de las fístulas anorrectales). *Semana méd.*, 1940, 47: 540.

Garat states that any fistulectomy requires special pre-operative care of the intestine. In patients with regular intestinal function, the colon will be well prepared by the administration of a mild purgative twenty-four hours before the operation, followed by an enema of plain water on the night preceding and in the morning three or four hours before the intervention. The usual practice of constipating the patient is condemned. A barbiturate should be administered on the eve of the operation to calm the patient. The perineal region should not be shaved, but the hair should be carefully cut with scissors; this is to be followed with a warm, soapy sitz bath. As sacral block anesthesia is indicated to insure deep and extensive regional anesthesia, the patient may take a cup of coffee or tea on the morning of the operation.

The basic requirements for the success of any fistulectomy are the exact determination of the principal tract with its primary and secondary openings and its collateral ramifications, and the determination of the anatomical relationships between the primary and accessory tracts and the sphincteric apparatus. The first requirement will allow complete extirpation of the fistula, and the second will show what part of the sphincter will be involved by the operation and to what degree the function of intestinal retention will be jeopardized. The complete exploration of the fistula must be done during the operative period because it requires superficial and deep perineal anesthesia. Instrumental exploration is better by far than injection of dyes or of contrast substances, the passage of which may be blocked by a vegetating granuloma, a foreign body, or a spasm of the sphincter, In addition, instrumental exploration does not interfere with the surgical act, as does the injection of foreign substances, and may be done gradually while the operation is going on. An anorectal retractor and flexible silver probes having an olivary tip are the instruments required for this purpose.

The author always begins with the exploration of the anorectal mucosa because he thinks that, as the fistulas originate at this level, it is more important to discover the primary opening first of all. Then he continues his investigation, using two or more probes. During the operation, he always completes his investigation carefully through the tracts that have already been incised. Various general rules have been established by different authors to guide the surgeon in his preliminary exploration; these rules should not be applied too strictly in view of the great anatomical variety of fistulas. It is often very difficult to discover the primary orifice, and great familiarity with the normal and pathological anatomy of the endo-anorectal region is needed to determine this orifice with the exactness necessary for surgical success. At times it is impossible to find a primary opening because the original process has spread until it has formed a complete fistula, while resorption of part of the inflammatory process has taken place and closed the primary orifice. In these cases, it is advisable to extirpate all the crypts of Morgagni which correspond to the actual fistula, according to the rules laid down by Salmon and Goodsall. Usually, the principal tract follows the lymphatic and venous vessels of the region, as it is determined by the progression of the septic lymphangitis or phlebitis initiated at the level of the original mucosal orifice. There are anal, cryptogenic (including anterior and posterior horseshoe), and low and high rectal fistulas. The basic principle of the treatment of the fistula is excision of the entire tract, principal as well as secondary, starting at the primary orifice.

The excision must be managed so as to allow permanent drainage of the secretions and cicatrization from the bottom toward the surface. Section of the subcutaneous portion of the external sphincter and of the lower part of the internal sphincter will not jeopardize the sphincteric function. When the fistulous tract passes above the anorectal fibromuscular ring, fistulectomy becomes a serious matter because this part of the sphincter cannot be cut without permanent loss of intestinal retention, and this is much less bearable than the chronic suppuration of the fistula. To avoid the excessive use of ligatures for the control of hemorrhage after the fistulectomy is finished, it is advisable to moisten the tampon gauze with a tannin preparation in flavic solution or with tannin in 50 per cent alcohol. A soft intrarectal tube is installed to prevent premature adhesion of the borders of the wound.

Careful postoperative supervision is indispensable to success. Two or three hours after the operation, hot fomentations are used continuously until the sitz baths are started. The patient is instructed to drink large quantities of liquids. A low residue diet is given until the bowels are opened spontaneously. When the sitz baths are started twenty-four hours after the operation, the intrarectal tube is removed and the anorectal tampon is also removed between this time and the next twelve hours. From the

sixth to the eighth day, when the granulation tissue is consolidated, topic applications are initiated, at first with antiseptics and later with solutions of cod-liver oil to stimulate the process of healing.

RICHARD KEMEL, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Redell, G.: Operative Anastomoses Between the Biliary and Gastro-Intestinal Tracts; A Review of Earlier Literature and a Clinical Study of 809 Swedish Cases. *Acta chirurg. Scand.*, 1940, 84: Supp. 59.

Redell's work is complete, well arranged, and thorough. The historical and bibliographical data are clearly outlined and critically analyzed. The bibliography itself contains 1,117 references, and the review of these references brings to light various interesting points which are discussed.

The material which Redell himself compiled and analyzed consisted of 809 cases of operative anastomosis between the biliary passages and the gastro-intestinal tract. These constitute practically all of the operations of this kind performed in Swedish hospitals between 1914 and 1937. Although the assembling of these records represents a monumental amount of work, there is one weakness in the author's statistics, which he freely admits: that is, the review of these cases represents the operative and diagnostic work of a large number of surgeons and many of the records are incomplete or ambiguous and the follow-ups are absent in many cases. Accordingly, although 809 cases are recorded, many of them are worthless from a statistical viewpoint. In those cases which were available for follow-ups the author gives some valuable and interesting data, and his conclusions seem justified.

The cases are divided into 12 groups, and each group is analyzed with regard to the type of operation, supplementary operations, operative mortality, postoperative course, duration of life after operation, complications, and the incidence of age and sex. The groups are as follows:

Cancer of the pancreas. There were 368 cases in this group. Despite the considerable operative mortality, the author believes that operation is always justified when the condition of the patient permits. A palliative anastomosis results in some prolongation of life, and the intense pruritus associated with the jaundice is frequently relieved. The subsequent course of a fair number of cases diagnosed as cancer of the pancreas proved that the operative diagnosis was erroneous. Eleven patients were living three or more years following an anastomotic operation for pancreatic cancer. Had these patients not been operated upon they probably would have died of the effects of chronic obstructive jaundice. Therefore, operation is justified in order to save this group of individuals if for no other reason. Constriction of the duodenum by a tumor of the pancreas occurred in 15 cases which necessitated gastro-enterostomy at the time of the biliary anastomosis or at a subsequent operation.

Cancer of the duodenal papilla. This occurred in 60 cases. Most of the patients in this group were helped palliatively. The outlook for the group as a whole is poor. However, the chance of success is greater in this group than in the verified pancreatic cancer group, since a papillary tumor can be treated radically without too serious operative risks.

Cancer of the bile ducts was present in 43 of the 809 cases. Only 2 patients lived a year or more in this group. Autopsy of a fair percentage of cases revealed that the biliary anastomosis had been distal to the invading tumor. Consequently, the author urges that more care be exercised in determining the site and extent of the tumor before the type of anastomosis to be used is decided upon.

Cancer of the gall bladder or liver existed in 14 cases operated upon. Results in this group were poor. In a rather large proportion of these cases autopsy revealed that anastomosis was done ill-advisedly because of the location and extent of the tumor.

Pancreatitis. This condition accounted for 76 cases. Anastomosis in these patients was followed by favorable results both early and late. More than half of them were living and in improved health one year after operation, and many were living and well for much longer intervals. Follow-up examinations were conducted in 25 of these cases and in 17 of them the patency of the anastomosis was demonstrated roentgenologically. Many of the patients had had operative diagnoses of cancer of the pancreas, but because of the subsequent course this condition could not have existed, and consequently these cases were classified as pancreatitis.

Stenosis of the bile ducts or papilla and persistent jaundice of unknown cause represented a heterogeneous group of cases, 65 in number. As a rule, the anastomosis appeared to have had the desired effect in these cases, and but rarely resulted in complications.

Stones in the hepatic or common duct were present in 76 cases. Results in these cases were rather universally poor, and indicated that anastomoses for these conditions are rarely warranted. Signs of persistent infection and obstruction were observed in a high percentage of cases.

Accidental injuries to the bile ducts usually resulted from operative accidents, although there was 1 case resulting from a traffic accident. Twenty cases were in this group. Complications arose after anastomotic operations in a rather high percentage of cases, and the author believes that fresh strictures constituted the main threat in these cases.

Postoperative external biliary fistulas were present in 23 cases. Subsequent anastomoses of various kinds were followed in many instances by continued symptoms.

Stenosis of the bile ducts following diseases of the stomach or duodenum accounted for 34 of the reported cases, and in benign cases the results were fully satisfactory.

Diseases of the liver. Anastomoses were done for this condition in 24 cases, and were followed by universally bad results. The importance of pre-operative diagnosis is emphasized by the results in this group.

Idiopathic dilatation of the common bile duct was present in 6 cases. Only 1 patient recovered completely.

An analysis of the results following the various types of operative anastomoses shows that there is no real difference between gastric and duodenal anastomoses. Anastomoses to the small intestine (duodenum and jejunum) are possibly somewhat to be preferred.

Ascending infection into the biliary tree has been raised as an objection to anastomosing operations. Only 9.4 per cent of the cases showed symptoms suggestive of this condition, and as a rule they followed ineffective anastomoses or obstruction of the anastomosis. Post-mortem findings in patients operated upon many years previously showed patent anastomoses with no gross or microscopic evidence of infection. Consequently, the author is inclined to minimize this objection to operations.

Follow-up roentgenograms in 89 cases showed reflux of the intestinal contents into the biliary tract in 62, without clinical evidence of harm in most cases. These findings are illustrated by reproductions in the original article.

Postoperative hemorrhages were not infrequent. The operative mortality was high throughout the series. The author stresses the fact that the greatest attention must be paid to pre-operative as well as to the postoperative treatment.

LUTHER H. WOLFF, M.D.

Browne, E. Z.: Variations in Origin and Course of the Hepatic Artery and Its Branches. *Surgery,* 1940, 8: 424.

The root structures of 280 cadavers were dissected to study the course of the hepatic artery and its branches to obtain a fair representation of what to expect in actual practice.

The nomenclature is as follows:

Common hepatic artery denotes the hepatic artery from the origin of this vessel until it divides into its terminal right and left branches.

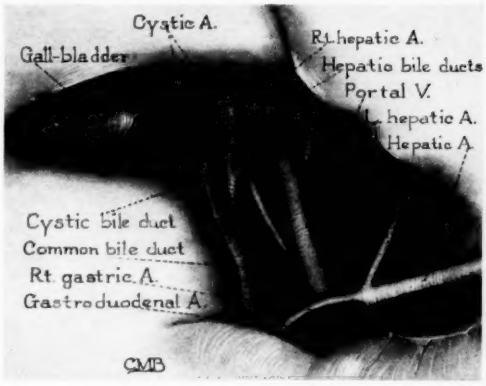
Normal common hepatic artery is an artery arising from the celiac axis and supplying both lobes of the liver.

Replacing common hepatic artery is one which supplies both lobes of the liver, but arising from another source than the celiac axis.

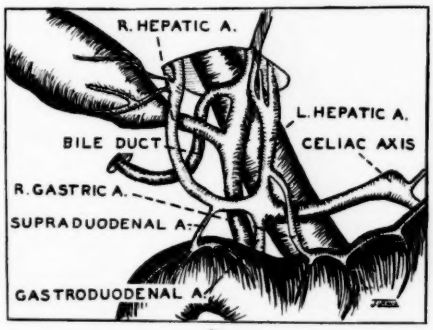
Accessory common hepatic is an additional artery (one or more) supplying both lobes of the liver in addition to a normal common hepatic.

Absence of the common hepatic means that the right and left lobes are supplied separately by separate arteries. In this case the artery of the right lobe would be a replacing right hepatic and the one to the left lobe a replacing left hepatic.

These terms also apply to other arteries discussed.



A



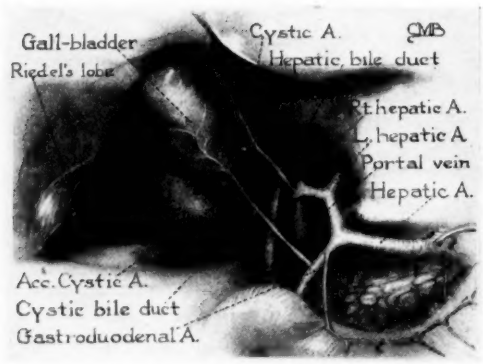
B

Fig. 1. A, The normal right hepatic artery passes posterior to the portal vein. B, The right hepatic courses in front of the ductus choledochus and the neck of the gall bladder. A very short cystic is to be noted, also a supraduodenal branch.

Normal common hepatic arteries were present in 92.8 per cent of the specimens. Long trunks were present in 202 specimens; they divided into right and left terminal branches about 1.5 cm. from the porta hepatis. These are the so-called classic type vessels of Branco. The remaining specimens had short trunks—the so-called *en bouquet* type of Branco.

The common hepatic artery was absent in 14 specimens (5 per cent). One replacing artery was present in 6 cases (2.2 per cent). Two of these arteries originated from the abdominal aorta and 4 from the superior mesenteric. One accessory artery occurred in only 1 case (0.36 per cent). Two accessory arteries were not observed in this series, and could not be found in any other series in the literature.

The gastroduodenal artery normally arises as a trunk from the hepatic artery, and immediately divides into three branches. This artery arose normally in 220 (81.4 per cent) of the specimens. Fifty-eight (26.3 per cent) of these came off of a short com-



A

B

Fig. 2. A, An accessory cystic artery from the gastroduodenal. The normal cystic courses ventral to the common hepatic duct and the accessory cystic courses in front of the common bile duct. B, Two accessory cystics, one from the aorta and the other from the superior mesenteric. These are very unusual.

mon hepatic trunk as one of the terminal branches, and 170 (77.2 per cent) came off of a long trunk as a first branch. Sixty-two (27.6 per cent) had an anterior relationship to the common bile duct in their entire course. This is of considerable surgical importance. One replacing gastroduodenal artery was present in 44 specimens, originating from various vessels of the celiac axis.

The supraduodenal artery supplies the first part of the duodenum; it arises from the gastroduodenal artery. It is not mentioned in textbooks, but was found in 56 (20 per cent) cases in this series. Its surgical importance lies in the fact that it runs anterior to the common bile duct, and may arise from various vessels.

The right gastric artery arose from the common hepatic artery in only 42.8 per cent of the specimens, thereby making the so-called "normal" origin appear erroneous. One replacing right gastric artery was found to be more common than the so-called normal type, as it occurred in 45 per cent of the cases. Five of these coursed anterior to the common bile duct; 14 ran ventral to the gastroduodenal artery, and 26 pursued a course anterior to the common hepatic artery. This artery was absent in 28 (10 per cent) of the cases.

The left hepatic artery arose from the normal common hepatic only 188 times (66.7 per cent). One replacing left hepatic artery occurred 19 times (6.8 per cent). In 12 instances the anomalous vessel sprang from the celiac axis separately; in 1 it came from the aorta; in 2 from the aorta by means of a replacing common hepatic; and in 1 from the left gastric artery. Seventy-one (25.3 per cent) accessory left hepatic arteries were found. One case showed two accessory left hepatic arteries.

A normal right hepatic artery occurred in 79.7 per cent of the cases. Numerous cases of abnormal course were found, in 2 the artery passed behind the portal vein, in 6 it was anterior to the common bile duct, in 4 it was anterior to the cystic duct, and in 15 it was posterior to this duct. In 44 it closely paralleled the duct to the neck of the gall bladder before turning upward or backward to the right lobe of the liver. This is very important from the surgeon's standpoint.

The cystic artery showed a large number of variations, exceeded only by those of the right gastric artery. Normally it comes off the right hepatic in the angle between the common hepatic and cystic ducts, just as the right hepatic artery emerges from behind the common hepatic duct. This condition was present in only 54.7 per cent. It coursed ventral to the common hepatic duct in 24 per cent of the cases, posterior to the common hepatic duct in 2 cases, anterior to the right and left hepatic ducts in 3 cases, and ventral to the common duct in 7 cases.

One replacing cystic artery was present in 46 cases; the origins were varied. Two replacing arteries were seen in 17 cases (6 per cent). One accessory was present in 58 specimens. Two accessory arteries were found in 3 instances. Multiple vessels were found in almost 1 of every 3 cases, which is of great surgical importance. HAROLD LAUFMAN, M.D.

Ohta, F.: Studies on the Detoxicating Hormone of the Liver (Yakriton). Ninety-Sixth and Ninety-Seventh Reports—The Difference of Urinary Elimination of Phenolsulfonphthalein Injected Intravenously in Rabbits with Different Liver Power, and the Influence of Yakriton Upon It. Ninety-Eighth Report—Contribution to the Usage of Yakriton Against Experimental Chromate Nephritis. *Tohoku J. Exper. Med.* 1940, 39: 11, 26, 37.

If phenolsulfonphthalein is injected intravenously in rabbits, the total amount of it excreted in the urine is almost the same in all rabbits, despite the strength of their liver detoxifying power. However, the rate of the dye elimination is greater in rabbits

with strong liver power than in those with weak liver power.

Yakriton, the detoxicating hormone of the liver, accelerates the rate of elimination of the dye in the urine to a greater extent in rabbits with weak liver power (Class B rabbits) than in those with strong liver power (Class F rabbits).

When yakriton is used thirty minutes prior to the injection of phenolsulfonphthalein, it is most effective in the amount of ½ R. A. U. (rabbit ammonia unit) per kilo of body weight.

Yakriton has a favorable therapeutic effect on experimental nephritis produced by potassium chromate, in doses not fatal to Class B rabbits.

SAMUEL KAHN, M.D.

Berman, C.: Primary Carcinoma of the Liver in the Bantu Races of South Africa. *South African J. M. Sc.*, 1940, 5: 54.

In Western Europe and in America primary carcinoma of the liver is a rare disease, only 600 cases being reported until 1930. In the pigmented races of mankind, on the other hand, primary cancer of the liver is very common.

The author collected 270 instances of primary carcinoma of the liver in the Bantu races of South Africa during the years from 1925 to 1933. Primary cancer of the liver accounted for the extraordinarily high figure of over 90 per cent of all cases of cancer in the native mine workers, and 19 per cent of all cancers in the native hospital of Johannesburg. It was found to be a disease of young adult males, the East Coast natives being six times more susceptible than the South African natives, perhaps because malaria and other parasitic infections are more prevalent in the tropical climate of the East Coast.

In a survey of the world literature, marked racial differences were noted. Primary carcinoma of the liver, rarely witnessed among all white-skinned people, was found to occur very frequently and with approximately equal frequency in both the dark-skinned Negro and the yellow-skinned Mongolian branches of mankind, and in the African aborigines and Javanese it was undoubtedly the most common neoplasm encountered.

Since racial factors appear to play such a prominent part, it is of interest that American Negroes and emigrated Chinese exhibit a distinct predisposition to the disease, whereas its incidence among Europeans living in Asia and Africa is as low as it is in the Western Countries. S. LLOYD TEITELMAN, M.D.

Gugliucci, A.: Gastric Secretory Function in Cholecystitis (La funzionalità secretoria gastrica nella colecistite). *Riforma med.*, 1940, 56: 714.

Gugliucci states that clinical observations in the past have revealed the association of gastric disturbances with cholecystitis and, in general, with disorders of the biliary tract; it has even been noted that some patients with cholecystitis presented gastric symptoms which simulated a disease of the stomach, while the cholecystitis did not manifest itself. Investigations by a number of authors have shown that cholecystitic patients often presented changes in the chemistry of the stomach which were expressed especially by hypochlorhydria or achlorhydria, but also by hyperchlorhydria.

This inconstant behavior of the stomach induced Gugliucci to make a personal study of the gastric function, using the histamine test. He investigated 20 patients: 15 had simple cholecystitis and 5 had calculous cholecystitis. The symptoms of these patients had started from a minimum of fifteen days to a maximum of eight years before the study and, in the chronic forms, the investigation was made during the stage of regression of an acute attack. A few days before the histamine test, the chemical function of the stomach in all the patients was studied by means of the usual Ewald meal. At the time of the histamine test, Einhorn's stomach tube was introduced and the gastric juice secreted under the influence of the tube was extracted after fifteen minutes; then a subcutaneous injection of histamine was given and the gastric juice was collected every fifteen minutes for one hour.

Hypochlorhydria was found in 45 per cent of the patients and hypochlorhydria with a tendency toward normal values of hydrochloric acid toward the end of the test was found in 10 per cent of the patients. Normal values for hydrochloric acid were present in 30 per cent of the patients, and hyperchlorhydria was found in the remaining 15 per cent. Consequently, in 70 per cent of the cholecystitic patients studied there was a change in the secretion of hydrochloric acid of the stomach, most frequently but not constantly in the minus direction. In addition, a constant relationship cannot be admitted between the behavior of the gastric secretion of hydrochloric acid and the nature of the cholecystitic disorder (calculous or not) or the time elapsed since the beginning of the disease.

The presence of hyperchlorhydric curves in patients in whom the examination of the gastric contents after the Ewald-meal test showed hypochlorhydria or achlorhydria makes it appear probable that the high percentage of cases of hypochlorhydria in patients with cholecystitis, as reported in the literature, would not have been found if the histamine test had been performed in all of these cases. Although it is not easy to explain the differences in the behavior of the secretory function of the stomach of patients with cholecystitis, the author thinks that a basic importance must be attributed to the factors which reflect the constitution of the patient, his neurovegetative, hormonal, and electrolytic peculiarities, rather than to the nature and the stage of the disease. RICHARD KEMEL, M.D.

Windfeld, P.: Three Cases of Hyperinsulinism with Hypoglycemia Treated by the Removal of Adenomas from the Pancreas. *Acta chirurg. Scand.*, 1940, 84:155.

After briefly reviewing the growth of our knowledge of hyperinsulinism the writer reports 4 typical

cases of adenoma of the pancreas, which tumors were removed by operation from 3 patients at Rigshospital, Copenhagen. All 3 patients had had pronounced hypoglycemic attacks unyielding to diet.

The first patient was a smith, aged forty years. At the operation an adenoma the size of a hazelnut was removed from the head of the pancreas. The microscope revealed the tumor to be many-celled, and benign, a typical insuloma. Its insulin content was from 15 to 20 international units per gram. The blood sugar rose to 400 mgm. per 100 c.cm. the day after the operation. On examination seven months later the patient's health and mental condition were normal. The fasting blood sugar was 107 mgm. per 100 c.cm.

The second patient was a male textile worker, aged twenty-two. At the operation two adenomas the size of big peas were removed from the tail of the pancreas. The microscope showed few-celled, benign insulomas. Tissue cultivation did not reveal any insulin activity. The patient was well when discharged. Hypoglycemic attacks, though less pronounced than before the operation, occurred again three months later. The patient is undergoing dietetic treatment at present.

The third patient was a farmer, aged forty-six. At the operation an adenoma the size of a cherry was removed from the head of the pancreas. The microscope showed a many-celled benign insuloma. The insulin content was 10 international units per gram. The blood sugar rose to 300 mgm. per 100 c.cm. the day after the operation. The health and mental condition of the patient were normal on discharge and are normal now after the lapse of two months.

The presence of the triad (1) periodic nervous disturbances when fasting, in connection with (2) hypoglycemia, and (3) pronounced benefit from the ingestion of glucose, is important in the diagnosis.

Disturbances in the pituitary, adrenal, and thyroid glands, and in the liver are mentioned as other causes of hypoglycemia.

The occurrence of slight hyperthyroidism in connection with insuloma is discussed (the third patient had a basal metabolism of from 130 to 117 per cent), and it is pointed out that insulomas are, practically speaking, never found by roentgenography because of their position and small size.

Cases of diffuse insular hyperplasia are mentioned in connection with the operative technique.

The mortality in these operations must be regarded as low in consideration of the gravity of the disease. According to Whipple, 5 of 56 patients from whom a tumor was removed died.

If attacks of hypoglycemia cannot be warded off by diet, an operation should be done. With protracted hypoglycemia irreversible changes gradually take place in the ganglia of the brain with persisting mental disturbances in consequence thereof. Furthermore, about 1 in 4 of the insulomas so far removed have been malignant with a tendency to metastasize.

Treatment with diabetogenic pituitary hormone is not advisable.

David, V. C.: The Indications and Results of Pancreatectomy for Hypoglycemia. *Surgery*, 1940, 8: 212.

Patients having attacks of nervous or gastro-intestinal disturbances coming on in a fasting state associated with a hypoglycemia with readings below 50 gm. per cent and relieved immediately by the ingestion of glucose very likely have islet-tumors of the pancreas. However, before exploration of the pancreas is indicated it is necessary to exclude as carefully as is possible all other causes of hypoglycemia, such as those related to the liver, adrenals, pituitary gland, thyroid gland, sympathetic nervous system, and other conditions related to the dextrose metabolism. In addition, a trial of dietary management especially in borderline cases should be carried out, care being taken that the frequent feedings do not produce excessive adiposity. When exploration is decided upon a careful search for an islet tumor must be made in all parts of the pancreas. This requires mobilization of the duodenum for a more thorough exploration of the head of the pancreas. When no tumor can be found, resection of the tail and body of the pancreas up to the superior mesenteric vessels is indicated. This operation has been carried out in 17 patients with favorable results; the records are available in the literature.

While instances have been reported in which tumors were found, not at the first operation, but at a second operation or at autopsy, or in a resected portion of pancreas, yet there are other instances in which no tumor was found at any time. Resection of a portion of the pancreas had for its object the hope that a tumor might be found in the resected portion or that a reduction in the islet secretion might be induced by removal of hyperplastic islet tissue or a considerable amount of normal islet tissue. There are 22 instances reported in the literature in which partial or subtotal resection of the pancreas was done and in which tumors were found in the resected portions of the pancreas. The results were similar to those in which the tumor alone was removed.

In a group of 17 patients who had a removal of from 35 to 60 gm. of pancreas for spontaneous hypoglycemia no tumor tissue was found. The resected portion was normal in 14, hyperplastic in 2, and the seat of pancreatitis in 1. Eleven patients were relieved of their symptoms, 7 having been followed up for more than two years. There was 1 operative death. In 1 patient the condition improved and in 4 there was no improvement. There were 15 patients in whom from 40 to 60 gm. of pancreas were removed. Ten of these are apparently cured. Of a group of 18 patients from whom less than 28 gm. of pancreas were removed, 4 died, 3 were cured, 3 showed improvement in their condition and 8 showed no improvement. In the group of 23 patients from whom more than 30 gm. of pancreas were removed, the mortality rate was 4.3 per cent. In a collected series of adenoma of the pancreas removed at operation the mortality rate was 16 per cent. This would indicate that resection of the pancreas is fairly safe

as compared to simple removal of an adenoma. Better results appear to follow extensive resection of the pancreas as judged by the reports in the literature.

The resection should be subtotal. It has been suggested that four-fifths of the gland be removed, that is, from 48 to 72 gm. The amount depends on the normal range in weight, from 60 to 90 gm.

The author resected 48 gm. of pancreas in a patient with marked hypoglycemia. No tumor was found but the patient has remained well postoperatively for nearly two years.

MANUEL E. LICHTENSTEIN, M.D.

MISCELLANEOUS

Totten, H. P.: The Intraperitoneal Use of Hypertonic Glucose Solution. *Surgery*, 1940, 8: 456.

This article presents the results of an experimental study undertaken to determine the value of hypertonic glucose solution in preventing the formation and re-formation of experimentally produced adhesions.

Hypertonic glucose in normal salt solution was selected for use in this study because the transudate which develops upon its introduction into the peritoneal cavity occurs consistently. By virtue of this large transudate, which is fibrin-free, mechanical isolation of intestinal coils acts to prevent the formation of adhesions between contiguous loops of bowel.

This solution, in the absence of intraperitoneal infection, is entirely innocuous except for the possible danger of dehydration, and then only if it is used in excessive amounts. Dehydration, however, may be easily controlled. This solution has an advantage over most solutions because of the fact that its sugar and salt content may be utilized.

It was found that 20 per cent glucose in normal salt solution is well tolerated in the normal peritoneal cavity. By giving an equal amount of normal salt solution subcutaneously, in order to obviate dehydration, as much as from 30 to 35 c.cm. per pound of body weight was tolerated without apparent ill effect. The tolerance beyond this limit was not tested.

Because of the fact that this solution is hypertonic, having a high diosmotic equivalent, a transudate rapidly forms. With 50 c.cm. of the solution being given intraperitoneally and 50 c.cm. of normal salt solution given subcutaneously in a series of animals, the following amount of transudate was obtained from the peritoneal cavity at the designated time interval.

The method used to produce adhesions was a combination of mechanical and chemical trauma which consisted of scraping of the anti-mesenteric portion of the small intestine with a knife blade until the serosa was abraded, followed by the application of tincture of iodine.

From these experiments, it was concluded that hypertonic glucose in normal salt solution, aside from possible effects of dehydration when used in excessive amounts, is entirely innocuous when placed within the normal non-infected peritoneal cavity. A large transudate forms, which is completely absorbed within a period of twenty-four hours. This solution, when used intraperitoneally, possesses value in preventing the formation and re-formation of experimentally produced adhesions. It apparently confers a certain degree of non-specific immunity upon the peritoneum. However, in the presence of gross peritoneal contamination its use hastens the spread of infection as it interferes with fibrin formation.

SAMUEL H. KLEIN, M.D.

ADVANCES AND INNOVATIONS IN THE FIELDS OF OBSTETRICS AND GYNECOLOGY DURING THE PAST TWENTY YEARS

EDWARD L. CORNELL, M.D., F.A.C.S., Chicago, Illinois

A SERIES of special articles reviewing briefly the advances made in obstetrics and gynecology during the past twenty years, contributed by many well known obstetricians and gynecologists, appeared in the October, 1940, number of the *American Journal of Obstetrics and Gynecology*—celebrating its twentieth anniversary.

SAMPSON writes on "The Development of the Implantation Theory of the Origin of Peritoneal Endometriosis." The conclusion that menstruation occurs in chocolate cysts of the ovary and produces hematomas of endometrial type, identical with those found in adenomyoma of the uterus, has been strengthened by further observations. The assumption that the fusion of an ovary containing one of these cysts with an adjacent structure is always an indication of the sealing of a perforation of the cyst is not correct. The inference that endometrial cysts actually rupture, their contents escaping into the pelvic cavity, has been confirmed by finding this phenomenon at operation.

At times during menstruation, blood, carrying bits of muellerian mucosa, escapes through patent tubes into the peritoneal cavity. Circumstantial evidence indicates that muellerian tissue in this blood, under favorable conditions, becomes implanted on any structure upon which it may lodge. It may be present only on the ovary or ovaries, only on the peritoneum, or in both situations. In patients with peritoneal endometriosis associated with an endometrial cyst of the ovary, both primary implants from or through the tubes and secondary implants from the cyst may be present.

If the bits of muellerian mucosa carried by menstrual blood escaping into the peritoneal cavity are always dead, the implantation theory also is dead and should be buried and forgotten. However, if some of these bits are even occasionally alive, the implantation theory also is alive.

CALDWELL, MOLOY, and ESOPO, writing on "The More Recent Conceptions of the Pelvic Architecture," give a résumé of their classification of pelves. The authors have studied more than 3,000 cases roentgenologically, and in not more than an estimated 2 per cent has a recognized cause for the pelvic abnormality been found. Rickets accounts for 1 per cent of all pelves studied, and the other 1 per cent is accounted for by a variety of causes. If approximately 98 per cent of all pelves are considered normal growth variants, it follows that the classification of these forms must be placed on a morphological basis and given prominence in all formal classifications.

The classification as now set forth is much more extensive and is divided into 2 main classes —morphological and pathological.

Certain roentgen methods of pelvimetry have been simplified to require not more than two films, a lateral and an anteroposterior view, but while these views are adequate for the purpose of roentgen measurement, they are not satisfactory for a comprehensive study of pelvic morphology.

The authors are opposed to the use of roentgen methods of prognosis which are based on the results obtained from mathematical formulations of a few pelvic and fetal diameters. The ultimate outcome of labor depends upon many other factors. The intricate variations in pelvic shape, although theoretically expressible in centimeters, cannot be so designated in practice; they can only be observed and expressed in descriptive terminology.

TAYLOR, in his discussion on "Changing Conceptions of Ovarian Tumors," said that the last twenty years have witnessed unexpected progress in the study of the nature and behavior of ovarian tumors. The greatest advances have been made in those aspects regarded more or less complete. Clinical advances have followed secondarily as a result of better differentiation.

A prerequisite for any acceptable classification of ovarian tumors is that it represents as nearly as possible the general opinion of the time and not simply the private views of some individual theorist.

Then follows a classification which should be considered provisional for 1940.

FRANK reviews "Outstanding Trends in Gynecology." The advances of the last twenty years have been aided by a tendency toward accuracy

and control, as shown by reliance on investigative machinery, by the employment of rigid statistical methods, by the development of standardization of bio-assay and chemical assays with the aid of physiologists and biochemists.

HEALY discusses "The Treatment of Uterine Cancer" and evaluates the operative and radium and x-ray methods. Radiation methods are applicable to all cases of cervical cancer, and the end-results are superior to those obtained by operation.

Critical studies of series of cases of cancer of the corpus uteri treated by radiation and surgery seemed to indicate that there are two major histological groups. One is of rather low malignant quality, known as adenoma malignum; in this group panhysterectomy by the vaginal or abdominal route may be expected to establish a permanent cure. The other is of higher malignant histological character, and in this group hysterectomy gives poorer end-results than when radiation alone or radiation followed by hysterectomy is used.

WATSON, writing on "Puerperal Sepsis," says that definite advance has been made along the following lines: recognition of the part played by the anaerobes in puerperal and postabortal infection; proof that these anaerobic infections are endogenous in origin; proof that such infections are predisposed to by shock, hemorrhage, prolonged labor, and traumatization of tissue; and realization that the removal of dead and decomposing material resulting from this type of infection can, in most instances, be effected with no risk and usually with great benefit to the patient.

There has also been identification of different groups of the beta hemolytic streptococcus and proof that only Group A is virulent in the human subject; establishment of the fact that infection with this organism is practically always exogenous; and proof that these organisms are usually conveyed to the patient by a carrier who harbors them in his mouth, nose, or throat.

It has been demonstrated that the risk of infecting patients is practically annulled by periodic nose and throat culture of all the members of the obstetrical staff and elimination of those who are carriers, and by the complete masking of the nose and mouth of all those who are attendant upon the parturient and puerperal woman. The persistence of the organisms in the environment of an infected individual, even for long periods after her removal therefrom, has also been demonstrated.

There has also been recognition of the necessity for most complete isolation of all such infected individuals and for proper provision for this in every maternity service, and the beneficial effects of sulfanilamide and its derivatives in streptococcal, gonococcal, and bacillus-coli infections have been discovered.

In "The Management of the Menopause" NOVAK states there is a definite field for both the parenteral and oral routes of administration of the estrogenic hormones, the former being much more effective when the symptoms are severe. The question of the possible hazard of inciting malignancy in individuals susceptible to cancer cannot be decided too arbitrarily in the present state of our knowledge, though it is fair to state that no impressive evidence of such a danger has as yet been adduced. Stilbestrol, because of its high degree of estrogenic activity, is very effective in the control of menopausal symptoms, but its use carries with it the disadvantage of toxicity in the considerable proportion of about 20 per cent.

EHRENFEST reviews the progress made in our knowledge of "Pregnancy and Disease." He concludes that within the last twenty years knowledge of the possible influence of pregnancy and disease on each other has been greatly enriched, though it remains wanting in many respects. In medical writings the formerly customary term "pregnancy complicated by disease" is being gradually replaced by the more optimistic phrase "pregnancy associated with disease," which, of course, does not deny the possibility that such association occasionally represents a very serious complication. However, the obstetrician now is less intimidated by the presence of a maternal disease, is less inclined to proceed forthwith with termination of the pregnancy, and exhibits much more interest in the coincident disease.

A careful consideration of "The Progress of Cesarean Section" from 1920 to 1940 by PHANEUF has shown that this operation is not a panacea for all obstetrical ills. The indications, which doubtless were extended because of the increased safety of the low or cervical operations, should be carefully evaluated and should be reduced to a minimum. While the general surgeon, technically, may perform a perfectly adequate operation, his training is not such that he may evaluate the purely obstetrical methods against abdominal delivery in a given case. In such instances, the requirement of a consultation with an obstetrical consultant, as is done in a large number of hospitals, will have a salutary effect in reducing morbidity and mortality. The improved results of cesarean section in the hands of the trained obstetrical specialist may not be due to the fact that

he can perform the operation better than the general surgeon, but rather to the fact that his obstetrical training has taught him the contraindications to this operation, which he observes.

FLUHMANN gives the history of the "Progress in Endocrine Studies of Reproduction," saying this is one of the brightest chapters in medicine. It has yielded many active substances of inestimable value in therapy.

HAMBLEN, writing on "The Endocrine Therapy of Functional Ovarian Failure," says that a large group of women with varying grades of spontaneous ovarian failure, with the exception of those in the climacteric ages, may be salvaged for the reproductive function by judiciously chosen and rationally administered organotherapy. Thyroid substance is most effective in patients with hypometabolism. The cyclic use of the ovarian sterols results in the initiation or restitution of normal ovario-endometrial responses in a certain group of patients. The combined and cyclic employment of equine and chorionic gonadotropins permits physiological salvage of another group of patients, those whose ovarian failure is related to hypogonadotropic activity of the pituitary gland. At present no clear-cut diagnostic criteria have been established for selecting appropriate groups of patients for cyclic sterol or cyclic gonadotropic therapy.

IRVING discusses "Modern Trends in the Artificial Termination of Pregnancy and Labor." The characteristic haste of some American accoucheurs to terminate labor is shown not only by their frequent resort to cesarean section but also by the readiness with which they effect operative delivery through an undilated cervix. The induction of labor toward the end of pregnancy, when performed for a distinct indication, is a most valuable procedure. Of late years, however, "delivery by appointment," usually by rupture of the membranes, for the convenience of the patient and of the doctor, has come into vogue with certain obstetricians. There is yet no evidence, when the cervix is effaced and there is some dilatation of the cervix and absence of cephalopelvic disproportion or of an abnormal presentation, that in the hands of a well-trained obstetrician such a procedure is often productive of harm. On the other hand, should prolapse of the cord occur, or puerperal infection set in, the attendant should be willing to accept the blame for an accident which probably would not have happened had he not interfered with a normal pregnancy.

According to STREETER the present trend in embryology is to regard all parts of the embryo and its auxiliary tissues as having functions to perform. The investigator endeavors to distinguish which of these functions are for the immediate maintenance of the organism and which produce actual developmental alterations. It is now realized that the embryo at all stages is a living individual, and is to be explained as a biological problem, rather than an exercise in purely morphological abstractions. One now begrudges the immense amount of effort that has been expended in the past on discriminating between the ectoderm, mesoderm, and entoderm cells.

RUBIN concludes his article on "Uterotubal Insufflation" as follows:

"The method of uterotubal insufflation has undergone gradual development from its incipiency in 1919 to its present status as a precise and safe clinical non-surgical test for determining tubal patency. CO_2, adopted as the gas of choice, has proved its usefulness and superiority over the years. . . . With hysterosalpingography it shares the same limitation; namely, the necessity for correct interpretation which in the last analysis is an art acquired by ample critical experience . . . uterotubal insufflation in careful hands can be utilized without untoward immediate accidents or sequelæ in all cases where it is properly indicated for diagnosis and therapy."

In the article on "The Unmarried Mother as a Medical and Social Problem," DANFORTH said that from the viewpoint of the obstetrician, it is difficult to imagine a group of patients who are more completely in need of proper obstetrical care and for whose children an efficient attempt to restore psychic normality is more necessary, than these young girls who have been so unfortunate as to find themselves among the unwed expectant mothers.

The leaders in obstetrics in this country believe that the expectant mother and her infant should have the care which is due them. They do not condone immorality, and they regret that any woman, particularly a young girl, should be in such a predicament. The broadening of human knowledge has brought with it great changes in the manner of dealing with problems of society.

HESSELTINE writing on "Mycosis and Trichomoniasis" says that twenty years ago gross ignorance prevailed on vaginal trichomoniasis and vulvar and vaginal mycoses. Today these conditions are usually recognized and adequately treated although improvement in therapy should and will likely take place. To the physicians of the United States goes priority for most of the important contributions in the understanding of these entities and credit for resourcefulness in the development and improvement of therapy.

ADAIR discusses the motives back of maternal welfare. They may be succinctly stated as the preservation of the health and lives of mothers and babies, the minimizing of suffering, and the maintenance and improvement of the human race. He then gives a brief history of the movement for better care of the obstetrical case in the United States.

EASTMAN concludes in an article on "Apnea Neonatorum" that in the presence of anoxia, apnea is resistant to all types of treatment other than correction of the anoxia itself. In a recent study of experimental anoxia even convulsive doses of alpha-lobeline, metrazol, and coramine, whether injected intravenously or directly into the carotid artery, were found to have no effect whatsoever on anoxic apnea; on the other hand a few insufflations with oxygen produced immediate breathing. The main desiderata in the treatment of apnea at birth would seem to be four in number: warmth, posture, aspiration of mucus, and delivery of 100 per cent oxygen to the pulmonary alveoli.

KOSMAK writing on "Contraceptive Practices" states that although acknowledged for centuries, the practice of contraception has assumed a different aspect during the past quarter of a century. One of the most signal changes is the acknowledgment of the responsibility of the medical profession in the application of proper and adequate contraceptive measures and their indications. A development of particular interest in recent years is the public health aspect of contraception. Both local and state organizations have given this official recognition. There is a sane and an insane approach to the problem of contraception—it is to be hoped that within another decade or two, an adequate solution may be reached.

In "The Evaluation of Hospital Statistics" WARD says that mortality and morbidity results of a hospital staff, and the percentage of successes, partial successes, and failures of certain lines of treatment are of the utmost importance in influencing the trend of practice and therefore the health of the community. The value of these percentages must be based upon the reliability and completeness of records. A successful follow-up clinic depends upon the fact that the surgeon who operated, or was in charge, will examine the patient. There is a need to establish standards for the comparison of results.

The author's experience with the employment of a professional statistician to audit results has confirmed most positively the opinion that such a procedure is not only a great advantage in facilitating the compilation of our statistics, but is an essential warranted by the great importance of a serious problem.

"The Increase in Hospital Deliveries" is discussed by PLASS. During the past two decades there has been a marked reaction against the old traditions that babies should be born at home; each year has seen an increasing percentage of hospital confinements. This tendency has been deprecated by many older practitioners who still insist that hospital delivery is not only more expensive but more dangerous, since the patient is subjected to contact with infectious agents and other influences against which she has no effective defense.

Up to this time it has been quite impossible to evaluate the claims of the rival groups; the proponents of each concept being quite irrevocably convinced of its virtues. There are, however, certain phases of the problem which may be considered with reasonable objectivity. It may be offered that the trend toward institutional delivery is sound and its expansion inevitable, provided the hospitals continue to improve their equipment and personnel, and agree to such restrictions on individual initiative as are most conducive to the greatest safety for the mother and her child.

DICKINSON writes on "The Application of Sculpture to Practical Teaching in Obstetrics." For telling effect and minimal mental effort only three-dimensional instructions can adequately demonstrate certain bodily functions and several structural relations. Chief among these is the mechanism of delivery. And herein there is every reason for combining the high art of sculpture with scientific research, whether this instruction be intended for the medical college or for popular teaching.

DANNREUTHER writes that the achievements and progress of the American Board of Obstetrics and Gynecology since its creation have been such as to make its influence felt throughout the country. Prospective applicants for certification are preparing themselves more thoroughly for the practice of obstetrics and gynecology, hospitals are demanding certification for appointment to responsible staff positions, certain medical societies are favoring diplomates of the Board, and even the lay public is becoming aware of the implications of certification.

GYNECOLOGY

MISCELLANEOUS

Huffman, J. W.: An Evaluation of Androgenic Therapy in Gynecological Practice. *Am. J. Obst. & Gynec.*, 1940, 40: 675.

The effects in 22 women who received androgenic therapy parallel those produced in laboratory animals by injections of testosterone propionate. Functional uterine bleeding was inhibited by the male sex hormone. In this group, no notable masculinizing changes developed, except occasional temporary hypertrophy of the clitoris. Three patients have been under observation for more than two years.

Testosterone propionate will bring about a cessation of genital activity in human beings, as it has been observed to do in adult female rabbits and rats. This effect is the result of pituitary rather than ovarian inactivation. The changes produced by the male sex hormone are temporary, with resumption of cyclic phenomena in the genitalia after administration is discontinued. When large doses of testosterone propionate (over 350 to 500 mgm.) are injected over a considerable period of time, temporary masculinizing changes, especially hypertrophy of the clitoris, may occur. Inhibition of activity in the lactating breast after the administration of testosterone propionate has been observed clinically and has been demonstrated histologically in animals. Reports indicate that reproduction is possible and that normal young have been born to women who have received male sex hormone prior to pregnancy.

There is considerable evidence to suggest that androgenic therapy has a place in the treatment of functional uterine bleeding, mastalgias, puerperal breast engorgement, and for the inhibition of lactation. Further investigation of its use in dysmenorrhea and in the treatment of menstrual molimina seems indicated. The use of male sex hormone may, perhaps, be more advantageous than that of estrogens in certain selected instances of menopausal disturbances.

EDWARD L. CORNELL, M.D.

MacBryde, C. M., Freedman, H., Loeffel, E., and Castrodale, D.: Stilbestrol; Clinical and Experimental Studies. *J. Am. M. Ass.*, 1940, 115: 440.

Using stilbestrol, the authors observed definite relief of hypogonadal symptoms in 52 of 56 cases. Hot flashes were decreased in all cases in which they were a prominent complaint. Headache was relieved in 16 of 21 cases in which it had been severe and energy seemed greater in 28 of 32 patients who complained of lassitude. Pruritus vulvæ was relieved in 8 of 9 cases and increased sexual desire was reported by 12 patients.

Untoward subjective effects, such as slight nausea and vomiting, separately or combined, occurred in 16 per cent of the cases.

Objectively, vaginal smears showed active estrous changes under stilbestrol therapy. After full vaginal smear changes were obtained at any dosage level and treatment was stopped, it took from twenty-one to thirty days for the smear to regress gradually to the castrate type. Symptomatic relief followed roughly the vaginal smear picture.

The endometrial biopsies revealed active proliferative changes after 10 mgm. were given intramuscularly in seven days, or after 20 mgm. were given orally in fourteen days.

From the subjective and objective effects in their series, the authors estimate stilbestrol to be from 50 to 66 per cent as effective by mouth as by injection.

In comparing stilbestrol to theelin, the former was found to be considerably more active.

ANTHONY F. SAVA, M.D.

Barnes, A. C.: A Method for Evaluating the Stress of Urinary Incontinence. *Am. J. Obst. & Gynec.*, 1940, 40: 381.

During the past year the author has been employing a test for the evaluation of the stress of urinary incontinence based on physiological principles. It consists essentially of three studies, all relatively easy to perform:

1. *Measurement of intravesical pressure.* With a standard volume of fluid in the bladder, and with the patient standing, direct manometric readings are obtained.

2. *Direct measurement of urethral resistance.* A small balloon composed of two superimposed finger cots is inserted in the urethra, filled to a known manometric pressure with a 90 per cent sodium-iodide solution, and an x-ray is taken. Studies on normal patients indicate that under these conditions the entire urethra should remain closed and should obliterate the balloon shadow at a pressure of 35 cm. of fluid, and it is at this pressure that the roentgenogram is taken.

3. *Indirect measurement of internal sphincter strength.* This determination is also made in conjunction with the roentgenogram, the film being taken in the oblique, and an indwelling watch chain used to mark the course of the urethra. As this film is exposed, the patient is asked to strain downward as hard as she can. With straining, intravesical pressures of from 60 to 80 cm. of water may be obtained, so that in this study the urethra is subjected to a much greater force than in the first film, but it is a force that is applied in a more physiological manner, i.e., from within outward.

In a normal person, a rise in intravesical pressure alone cannot force fluid through the internal sphincter without a detrussor contraction of the bladder. Funneling of the bladder floor toward the urethra indicates that mere increase in intravesical pressure, unassociated with contraction of the trigone, has

forced fluid through the internal sphincter, which denotes a weakening of this sphincter.

The information obtained from these studies permits a much better understanding of the patient's incontinence. With such information in mind, a complete program for the treatment of partial incontinence in women should include measures designed to (a) lower intracystic pressure when this is found to be increased, and (b) re-establish urethral resistance when this is diminished.

EDWARD L. CORNELL, M.D.

Furuhjelm, M.: The Excretion of Estrogenic and Androgenic Substances in the Urine of Women; An Investigation of 14 Healthy Women, 10 Cases of Myoma, and 2 of Castration. *Acta obst. et gynec. Scand.*, 1940, 20: Supp. I.

The excretion of estrogenic and androgenic substances was determined in two-day lots of urine from 14 healthy women for at least one ovarian cycle. The same investigation was carried out on 10 women with myoma of the uterus, with the difference that the samples of urine were collected for two weeks before and two weeks after the operation, if any took place. The estrogenic substances were determined quantitatively according to a method learned by the writer at the National Institute for Medical Research in London. Mice were used as experimental animals.

The androgenic substances were determined spectrophotometrically, according to Zimmermann. Biological control experiments on capons and rats indicated that the amount of spectrophotometrically determined substances is proportionate to the amount of biological active androgenic substances.

The curves representing the excretion of estrogenic and androgenic substances in 14 healthy women reveal the following:

1. A typical configuration.
2. One or, occasionally, two pronounced peaks in the excretion of estrogenic substances.
3. A heavy decrease in the estrogenic excretion during menstruation.
4. A variance between 20 I.U. and 400 I.U. of estrone in the estrogenic activity of the urine for two days. During the ovarian cycle, a healthy woman excretes on the average estrogenic substances with the same estrogenic activity as 1,100 I.U. of estrone.
5. In the great majority of cases (10 of 14), there is no decrease in the androgenic secretion during menstruation.
6. A distinct tendency to parallelism is seen between the excretions of androgenic and of estrogenic substances during the intermenstruum.

Similar conditions were found in the curves representing the excretions of estrogenic and of androgenic substances in the 10 women with myoma.

Finally, 2 castrated women were examined. No estrogenic substances could be shown in the urine up to two weeks after castration. Androgenic substances were present in the same amounts after and before the operation, and in approximately the same amounts as in normal women.

Berutti, E.: The Cause and Present Therapeutic Foundations of Human Sterility (Eziologia e basi terapeutiche attuali della sterilità umana). *Ginecologia*, Torino, 1940, 6: 99.

The principal points of the popular lecture on sterility given by Berutti are summarized in the following concepts which he offers for assimilation by the public and the medical profession:

1. Nowadays the study of the causes of sterility requires a series of investigations which reaches far beyond the study of the woman alone, and especially of the woman considered simply from the point of view of her organs of reproduction.
2. The causes of human sterility reside in the male more often than is generally believed, and the only manner in which this can be determined is by the clinical examination of the genital apparatus and the microscopic examination of the sexual secretion of the individual.
3. Although a normal size or a perfect harmony of the physical form is usually associated with a corresponding development of the genital organs, it is not exceptional to find that a general physical development even above the normal one may be accompanied by an absolutely deficient development of the organs which are more directly concerned with the reproduction of the species.
4. The volume of the uterus in itself is not always an indication of its degree of physiological development.
5. The arrested or retarded development of the female genital organs is not always caused by an infection with peritoneal localization; an infection of any other organ or system may bring about similar results and the infection itself need not necessarily be very severe.
6. Female sterility should be prevented and cured during the prepuberal and the puberal period.
7. There are anomalies and deficiencies of genital development which may simulate conditions of prenatal life or of infancy, but which may be due to conditions of sexual life subsequent to marriage, for example, immature genital development and regression because of voluntary avoidance of pregnancy.
8. There is danger of gonorrheal infection of the female genital organs at the time of birth when the fetus passes through the maternal vagina and, even more frequently, sterility due to gonorrheal processes may occur during the period extending between birth and puberty through rape, familial contact, and epidemics in institutions and schools.
9. With regard to the adults of both sexes, the gonorrheal infection does not necessarily have to be particularly virulent to produce grave and finally incurable consequences; in fact, often the infection has been rather slight and of short duration.
10. The gravity of the gonorrheal infection differs greatly in the two sexes: usually the capacity for fecundation remains intact in the male, while even very slight infections cause chronic inflammatory processes in the female with incurable functional results.

11. Women may be infected irremediably without knowing it because they may not present any subjective symptoms of the disease and, when they come to the consultation disillusioned and tired of waiting in vain for pregnancy, the usual gynecological examination is incapable of discovering any objective alteration in the internal genital organs.

12. Because of tissue undernourishment and abnormal chemistry, insufficient development of the genital organs offers less resistance to infection in general and, in turn, infection contributes to the arrest and the deviation of the regular development of the genital organs.

13. There are many other minor causes of sterility. The presence or absence of libido has no importance for fecundation, but hypererotism might favor the appearance of spastic syndromes. It seems probable that sexual excesses present at times an obstacle to fecundation, either through progressive impairment of the functional activity of the male element, accompanied at times by periods of impotence due to a gradual decrease of the response of the nervous centers to the hormonal stimulation, or through the establishment of congestive and irritative processes in the female genital organs. Sterility may be due to hypovitaminosis, changes in the chemical reaction of the vagina, abnormal position of the genital organs (such as uterine retroversion and hyperanteflexion), tumor of the uterus, cyst of the ovary, and anovular cycle.

The first step in the treatment of sterility must consist of recognizing and trying to eliminate any morbid changes present in the organism: this requires a thorough clinical examination from the anatomicopathological, functional, and psychic points of view. If general treatment is indicated, patience is absolutely necessary. In endocrine treatment, the principal object is the normalization of the testicular or of the ovarian function. Surgical intervention may be necessary to remove an obstruction of the seminal ducts in man or of the cervix in woman. Insufflation of the tubes is followed by pregnancy in a certain percentage of cases. Surgery for female sterility must be strictly conservative. Artificial insemination must be considered with great reserve.

The statistics of the authors at the Center for the Study and Cure of Sterility (University of Turin) show 20 per cent of positive results in primary and 19 per cent in secondary sterility: 33.3 per cent of the positive results were obtained with hormone therapy given for from three to five months, 20 per cent with uterosalpingography, and 17.6 per cent with vaginal or uterine local treatment. Prophylaxis is paramount. RICHARD KEMEL, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Aldridge, A. H.: Retrodisplacement of the Uterus in Relation to Pregnancy. *Am. J. Obst. & Gynec.*, 1940, 40: 361.

Retroversion and its associated conditions are not infrequently the cause of sterility, early abortion, and unpleasant symptoms following abortion and delivery. Unless it is known that retroversion preceded pregnancy, postabortal and post-partum retroversion should be treated by palliative means to reduce the incidence of permanent retrodisplacement of the uterus. Selection of cases for treatment by surgical means should be based on painstaking physical examinations and therapeutic tests to be sure that pre-operative pelvic symptoms are gynecological in origin. Associated functional and pathological conditions of the uterine adnexa more frequently constitute indications for operation than retrodisplacement of the uterus. Operations for the cure of retroversion and its associated conditions should usually

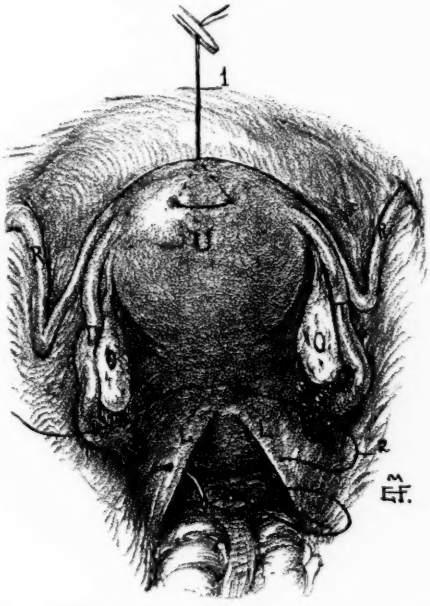


Fig. 1. Shows the uterus, U; tubes, T; ovaries, O; round ligaments, R; and uterosacral ligaments, L. The uterus is being pulled forward by a chromic catgut No. 1 suture (1), which is used for traction during the operation and, finally, as a means of temporarily suspending the uterus to the anterior abdominal wall. Also a linen suture (2) is shown, which has been passed through the posterior surface of the uterus (U), and the uterosacral ligaments (L) in accordance with the technique recommended by Noble for shortening these ligaments.

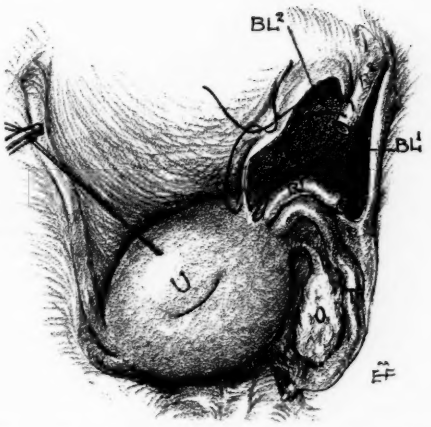


Fig. 2. Shows the proximal end of the distal fragment of the round ligament (R^2) being sutured with linen into the denuded angle at the junction between the uterus (U) and proximal fragment of the round ligament (R^1).

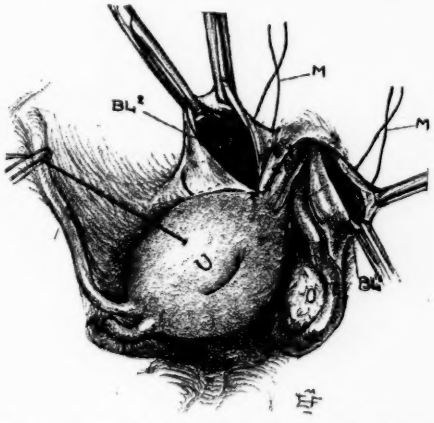


Fig. 3. Shows the two portions of the round ligaments (R^1 and R^2) united to each other with interrupted sutures of chromic catgut No. 1. After the round ligament (R^1 and R^2) has been reconstructed it will be noted that both layers of the broad ligament are much relaxed, a fold of the lower layer of the broad ligament (BL^2) being left near the uterus and a fold of the upper layer (BL^1) being left near the lateral wall of the pelvis. The relaxation in both these folds is taken up with mattress sutures (3) of chromic catgut No. 1.

be aimed at preserving the child-bearing function and establishing anatomical and physiological conditions which will be favorable for subsequent pregnancies. Retroversion of the uterus is caused by relaxation of the broad as well as of the round ligaments, and operations for the cure of retrodisplacements of the uterus should be done by techniques which restore the function of the broad as well as of the round ligaments. The incidence of failure in operations for retroversion could probably be reduced if conception could be postponed until at least six months after operation. The Bissell operation is described in detail.

In the discussion BAER said he was in complete accord with much that the author had said. However, he was in complete and fundamental disagreement with him on the rôle of the round ligaments. He believed the play of the round ligaments had no part in the establishment and maintenance of antedisplacement of the uterus.

HEANEY said the symptoms are not due to the retroversion ordinarily but to the accompanying pathology. The backaches associated with retroversion usually clear up when the accompanying erosion or endocervicitis has been cured. The dysmenorrhea of retroversion also clears up when the cervical pathology is cured. EDWARD L. CORNELL, M.D.

Albers, H.: Pregnancy Toxicosis, a Functional Problem (Die Schwangerschaftstoxikose, ein funktionelles Problem). *Klin. Wchnschr.*, 1940, 1: 513.

The dangers of hyperemesis gravidarum consist in acetonuria and hypochloremia. As the chloride content of the blood diminishes, the residual nitrogen increases. If the hypochloremia is not recognized and treated, the patient will die of uremia. However, if chloride in the form of sodium-chloride solution is administered intravenously or rectally, the chloride content of the blood will be raised and the residual nitrogen diminished, with resulting recovery. Thus serious metabolic disturbances may be caused by a purely neurofunctional disorder.

In early eclampsia one has to deal with a pathological reaction of the body to pregnancy which involves the brain via the vascular system. The late toxicoses are manifested by albuminuria, hypertension, and edema. The various forms may occur in combination. In spite of the low blood sugar during pregnancy, the organism has a tendency to increased glycogenolysis. In the toxicoses of pregnancy the carbohydrate reserve is very low, so that during labor, the pregnant woman is forced to draw on fat and protein reserves for muscular activity. As pregnancy advances, the fat content of the blood is increased; this increase corresponds to the increased carbohydrate demand—the greater the carbohydrate deficit, the greater will be the hyperlipemia. The serum protein is diminished even in normal pregnancy, and becomes markedly diminished in the pregnancy toxicoses. The shifting of the albumin-globulin ratio may be considered a thinning process. The water-combining power of the serum is already decreased in the normal pregnant woman and in pregnancy toxemia it is greatly decreased. The plasma volume is essentially increased with only a slight increase in the total erythrocyte volume. The diminution of serum protein in the toxicoses of pregnancy, together with a simultaneous concentration of the blood, indicates an absolute loss of serum protein. The closer the approximation of the protein content of the serum and the tissue fluid, the less fluid will flow from the tissues into the vessels, resulting in metabolic pre-stasis. The hydrophilous capacity of the tissues is increased by the abundance of sodium, and thus provides the prerequisites for pre-edema.

The therapeutic conclusion to be drawn from these observations is that an attempt must be made to combat carbohydrate deficiency in pregnancy. The increase in pressure of the cerebrospinal fluid in pregnancy toxicosis must be prevented and the flow of fluids from the vessels into the tissues must be prevented. To this end, the pregnant woman should receive a diet rich in carbohydrates, while proteins should be restricted so as not to exceed from 70 to 100 gm. daily. In cases of severe pregnancy toxicosis, the fat intake should be limited to 30 gm. daily. The increased pressure of the cerebrospinal fluid may be relieved by repeated injections of 100 c.cm. of a 50 per cent glucose solution. The therapeutic effect, i.e., the increased water-binding power of the serum proteins, has not yet been fully explained. (WINKLER). EDITH SCHANCHE MOORE.

PUERPERIUM AND ITS COMPLICATIONS

Rodríguez Ximeno, M.: Visceral Tetanus in Pregnancy and the Puerperium (Tétanos visceral en el estado grávido-puerperal). *Arch. uruguayos de med., cirug. y especial.*, 1940, 16: 449.

The author reports 3 cases of tetanus (2 post-abortive and 1 after unhygienic delivery). He then reviews the literature and discusses the treatment and prophylaxis in detail.

The first case was that of a thirty-four-year-old multipara who, at the third month of pregnancy, attempted a self-induced abortion. There was considerable bleeding which the patient stopped with a vaginal tampon which was left in the vagina for eight days. Twenty days after the attempted abortion, pains in the lower jaw developed and trismus appeared. The patient was treated with 2 c.cm. of 5 per cent luminal daily and was given a total of 550 c.cm. of anti-tetanic serum intramuscularly, intravenously, and subcutaneously. The patient recovered and went on to full term with a live infant.

The second case was that of a thirty-three-year-old multipara who had been delivered at home eight days previously of twins by an amateur midwife. She was admitted to the hospital in serious general condition with trismus and rigidity of the neck. The patient died twelve hours after admission in spite of treatment with 25 per cent magnesium sulfate administered intramuscularly and 100 c.cm. of anti-

tetanic serum. One of the twins also died of tetanus, possibly through contamination of the umbilical cord.

In the third case a thirty-year-old multipara had attempted an abortion after forty days of pregnancy. Eleven days after inducing the abortion she was admitted to the hospital with trismus, rigidity of the neck, and exaggerated reflexes. The patient received vaginal irrigations with Dakin's solution, luminal 5 per cent, magnesium sulfate, ether anesthesia, calcium chloride given intravenously, and a total of 1,590 c.cm. of anti-tetanic serum given intramuscularly, intravenously, intraspinally, and subcutaneously. Also 3 doses of anatoxin were given to stimulate active immunity. The patient recovered.

In reviewing the literature the author calls attention to Spiegel's report in 1915 of 65 cases with a mortality of 83.1 per cent. The author notes that differential diagnosis must consider hysteria, trismus of local origin, meningitis, and strychnine poisoning.

The treatment consists of local antisepsis of the wound or portal of entry, general sedative measures to control the muscular spasms, administration of large doses of anti-tetanic serum for passive immunity, and, as the result of the work of Ramon, the use of anatoxin to promote active immunity. By large doses of serum the author means 500 to 2,000 c.cm. of anti-tetanic serum.

The author summarizes his report as follows:

In 3 cases of visceral tetanus there was a mortality of 33.33 per cent. The portal of entry in these cases was the uterus. None of these patients had received prophylactic serum. The cured patients had an incubation period of more than ten days. Tetanus did not interfere with the progress of the pregnancy or the delivery of a normal infant. The treatment consisted of sedative medication with luminal, chloral, or magnesium sulfate, which was injected intramuscularly, 10 per cent calcium chloride given intravenously, and ether anesthesia; large doses of anti-tetanic serum were administered by all available routes and anatoxin was given for active immunity. Visceral tetanus per uterus is due to faulty asepsis during labor or to contamination by sounds or forceps during attempted abortion.

JACOB E. KLEIN, M.D.

NEWBORN

Fontana, G.: Normal and Hypertrophied Thymus in Newborn Infants (Il timo normale ed il timo ipertrofico nel neonato). *Folia demograph. gynaec.*, 1940, 37: 291.

The author examined the thymus of 30 newborn infants, most of whom had died of accidents incident to delivery. A table is given showing the weight and measurement of the thymus in the different cases and giving a brief résumé of the clinical history. The histological pictures are reproduced.

The average weight of the thymus in these cases was 12.5 gm., not much less than the weight of 12.6 gm. given as normal by Hammar and Gaifami. The lightest thymus weighed 6.7 gm. and the heaviest 26 gm. In 9 cases the weight was more than 13 gm. The average length of the organs was 5.3 cm., breadth 3.9, and thickness 1.8. In the cases in which the thymus was hypertrophied the length was almost normal; the increase was in breadth and thickness. Hypertrophy of the thymus was found in 7 males and in only 2 females. Generally, an increased weight of the thymus was found in infants with a higher than normal body weight, but not always. One fetus which weighed 3,630 gm. had a thymus that weighed 6.7 gm., while one that weighed 2,400 gm. was found to have a thymus that weighed 26 gm.

The increased weight of the thymus was not caused by fatty infiltration or degeneration, increased connective tissue, or congestion. It was due in all cases to an increase in both the cortex and medulla of the gland, with the predominant increase in the cortex.

The sex glands and the hypophysis as well as the thymus were examined in all of the cases. There was a disturbed development of the follicles in females and rarefaction of the seminiferous tubules in males. This would seem to be due to the fact that the cortex of the thymus has an inhibiting action on the development of the sex glands, analogous to that seen in status thymicus in children, or there may be a disturbed reciprocal relationship between the thymus and the sex glands. It is hard to explain the great increase of chromophil cells in the hypophysis in cases of enlarged thymus.

AUDREY G. MORGAN, M.D.

GENITO-URINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Lauber, H. J., and Hartmann, G.: The Treatment of Tumors of the Kidney and Its Results (Die Behandlung der Nierentumoren und ihre Ergebnisse). *Arch. f. klin. Chir.*, 1940, 198: 306.

The experiences at the Marburg Clinic, as well as those reported in the literature, testify to the fact that the prognosis of tumors of the kidney is bad. During the period from 1928 to 1938, 21 cases of hypernephroma in adults and 6 cases of adenosarcoma in children were observed. Fifteen of the adults and 5 of the children were nephrectomized. Of the 21 adults, 4 are still alive, from eleven months up to three years and nine months after operation. Of the 6 children only 1 is still alive, two and one-half months after operation, and is already suffering from a recurrence. All of the other children died within a few months. Of the adults, 14 showed recognizable hemorrhages macroscopically and 2 microscopically. Among the children blood was never found in the urine.

On the basis of 14 roentgenographic pyelographies, the characteristic symptoms are discussed; they are: filling defects of the renal pelvis or renal pelvic system, compression and distortion of the renal pelvis, and displacement of the ureter. However, filling defects are never seen in cases of renal tumors in children, but in their stead longitudinal growth and often compression of the renal pelvis is noted. This longitudinal growth, if unilateral, is strikingly characteristic of renal tumor. The fact that the tumors do not perforate the renal pelvis of children explains the absence of hematuria.

(Dietrich Blos). Louis Neuwelt, M.D.

Kretschmer, H. L.: Adenomyosarcoma of the Kidney (Wilms Tumor); Report of 3 Cases. *Arch. Surg.*, 1940, 41: 370.

Adenomyosarcoma of the kidney has certain characteristics which ordinary renal tumors do not possess and may be enumerated as follows:

1. It is essentially a disease of infancy and childhood.
2. As a rule it runs a silent rapid course.
3. The histological picture is unique and singularly characteristic.
4. The outcome is generally fatal.

A multiplicity of theories have been advanced from time to time regarding its pathogenesis.

The embryonal structure of these tumors is their most distinguishing feature with a variety of tissue of abortive renal elements. The types of cells and amount vary in different tumors. The tumors are usually myxomatous tissue composed of masses of polymorphous nucleated cells in which are imbedded gland or duct-like figures resembling uriniferous tubules which may be sparse or abundant. These embryonic tubules in a heterogeneous matrix are the most conspicuous features. In addition there are epithelial and connective-tissue elements. The connective-tissue elements consist of loose stroma, undifferentiated round cells, and striated and nonstriated muscle fibers. Cartilage and bone cells may be present in some of these tumors, but they are rare.

A palpable tumor is the most common early symptom. The enlargement is always progressive and painless. Hematuria is rarely present. Anemia and loss of weight are late manifestations as are also the pressure symptoms, as nausea, vomiting, constipation, and shortness of breath.

The presence of an abdominal tumor which has rapidly increased in size and is hard and nearly always painless should lead to a tentative diagnosis of Wilms tumor. The diagnosis should be based on the results of complete urological study in every case. The diagnosis is further strengthened by changes in the pyelogram that are compatible with tumors. Cystoscopic examination, catheterization, and functional tests are carried out before removal of the tumor is undertaken. It is necessary to rule out retroperitoneal tumors as neuroblastoma, sarcoma, and lipoma. At times it may be necessary to differentiate enlargements of the spleen, tumors of the ovary, and cysts of the omentum.

Six types of treatment have been followed: (1) nephrectomy alone; (2) the use of serum in conjunction with nephrectomy, Coley having reported good results from this method; (3) roentgen therapy to reduce the size of the tumor and kill embryonal cells, followed by nephrectomy; (4) roentgen therapy followed by nephrectomy and by another course of roentgen treatment; (5) nephrectomy followed by postoperative roentgen treatment in order to destroy any residual malignant embryonal cells; and (6) roentgen treatment alone. John A. Loef, M.D.

BLADDER, URETHRA, AND PENIS

Ockerblad, N. F., and Carlson, H. E.: Congenital Hour-Glass Bladder. *Surgery*, 1940, 8: 665.

Hour-glass bladder may be defined as a congenital anomaly in which the bladder is divided into two smaller cavities by a transverse constriction, without change in total volume and without change in the component parts of the bladder wall. The constriction may occur either above or below the ureteral orifices. Congenital hour-glass bladder must be distinguished from (1) diverticulum, (2) patent urachus, (3) vesica duplex or vesica bipartita, (4) absence of the prostate and seminal vesicles, and (5) constriction due to inflammatory conditions, or as a result of an injury.

Etiology. The condition of congenital hour-glass bladder must have some reasonable embryological

basis for its occurrence. The theories which have been advanced are:

1. Atavistic relationship or hour-glass bladder normally found in some animals
2. Persistence of the embryonic ureteric membrane
3. Unequal growth of the two bladder anlagen

Diagnosis. The symptoms are quite variable. Early symptoms include urinary difficulty, dysuria, and enuresis. Thirty-three per cent of patients, however, have no symptoms until later life. Acute urinary retention, hematuria, and the symptoms of a superimposed cystitis are then the most common.

On cystoscopic examination, the bladder is found to be divided into two cavities, one above the other. The ureters may open into either cavity. The relative size of the cavities is variable, but the combined capacity is that of a normal bladder. When the cystoscope is passed into the upper cavity, normal trabeculations and vessel markings are seen.

Treatment. The treatment should be directed toward enlarging the opening between the two cavities, so as to allow better drainage. Since the total capacity is normal, it seems plausible to follow some procedure concerned with the eradication of the fibrous ring, whether the ureters open into the upper or into the lower cavity. JOHN A. LOEF, M.D.

Winer, J. H.: Contracture of the Bladder. Elastosis of the Bladder. *J. Urol.*, 1940, 44: 485.

The observation of an abnormal amount of elastic tissue in the bladder wall is unusual. The newly formed connective tissue in instances of chronic cystitis with contracture of the bladder may be rich in elastic fibers. However, a review of the literature on the subject revealed no report resembling the following severe case.

A white married woman, aged sixty-four, was hospitalized in a semistuporous condition. The only past history obtained was that she experienced three attacks of renal colic in the previous twenty years. For two days previous to hospitalization there was constant hematuria, dysuria, frequency, and incontinence.

On examination the patient was stuporous, emaciated, and dehydrated. The blood pressure was 150/68. There was a bulging tender mass on the right side of the abdomen and edema of the lower extremities. The essential laboratory findings were as follows:

The leucocytes numbered 39,600 with 74 per cent polymorphonuclears. The urine was grossly bloody. The blood urea nitrogen was 47 mgm. per 100 c.cm. plain. X-ray examination of the abdomen was negative with the exception that a concretion was noted opposite the second lumbar vertebra. The condition rapidly grew worse and she died on the third day after admission.

The essential post-mortem findings were as follows:

The right kidney pelvis contained sanguinopurulent fluid and the left pelvis was full of a grayish white purulent fluid. The ureters were extremely tortuous, dilated, and kinked. The bladder was small, measuring 6 cm. in diameter. The mucosal surface was gray in some portions and red, congested, and ulcerated in others. The bladder wall contained a small diverticulum and also a small yellowish cyst.

Microscopic section through the bladder wall at the left ureteral orifice showed squamous-cell metaplasia. Sections of the bladder showed acute and chronic cystitis. The van Gieson elastic stain showed the atrophic muscle fibers surrounded by dense accumulations of fragmented elastic tissue.

JOHN A. LOEF, M.D.

Young, H. H.: Operative Technique in the Treatment of Vesical Diverticula. *J. Urol.*, 1940, 44: 458.

As a result of the study of diverticula of the bladder it is essential to stress the frequency with which dangerous pressure may be exerted by the diverticulum upon one or both ureters.

It is suggested that diverticula be removed intravesically. When the ureter lies within the wall of the diverticulum, its orifice opening into the cavity, it has been found possible by a special plastic procedure in which the incision is carried down within the diverticular wall around the ureteral orifice to remove the diverticulum intravesically, and thus preserve the ureteral orifice and draw it up into the bladder when the wound is closed.

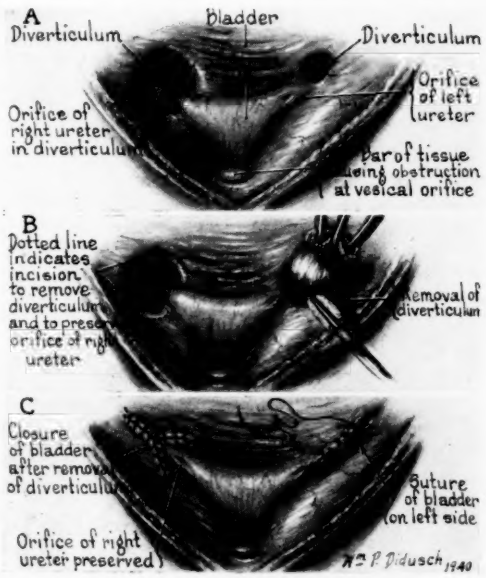

A
Diverticulum
bladder
Diverticulum
Orifice of left ureter
Orifice of right ureter in diverticulum
Bar of tissue causing obstruction at vesical orifice
B
Dotted line indicates incision to remove diverticulum and to preserve orifice of right ureter
Removal of diverticulum
C
Closure of bladder after removal of diverticulum
Suture of bladder (on left side
Orifice of right ureter preserved
M. P. Didusch 1940

Fig. 1. The author's first case of diverticulectomy and technique employed in removal of 2 diverticula. Y plastic was first used in this case to preserve terminal portion of ureter.

In certain cases it has been found possible to draw the diverticular sac into the bladder with a large glass tube and powerful suction.

In the majority of cases, however, an incision is made around the orifice of the diverticulum through the mucosa and submucosa, traction made with forceps, and enucleation carried out from within its fibrous sac. However, when the diverticulum extends laterally, it may sometimes be easier to carry the suprapubic incision through the lateral wall of the bladder down to the diverticular orifice. Through this enlarged wound the enucleation of the sac may be facilitated. JOHN A. LOEF, M.D.

Pearse, R., and McComb, R. A.: The Treatment of Infiltrating Tumors of the Bladder. *Canadian M. Ass. J.*, 1940, 43: 106.

The methods of treatment of infiltrating tumors of the bladder fall roughly into two groups. The first group, comprising x-ray therapy, radium, and diathermy, aims at the destruction of the tumors *in situ*. The second group, comprising local excision, partial cystectomy, and total cystectomy, aims at removal of the diseased area intact. The ideal is destruction of the tumor without mutilation of the host, but this cannot be attained in the treatment of infiltrating tumors.

Cancer of the bladder may be treated by radical or palliative methods. Radical methods with the object of curing the patient should be advised when the disease is limited and the patient otherwise healthy. It is well known that there are cancer cells in apparently healthy tissue adjacent to the tumor.

In the decade from 1923 to 1933, partial resection of the bladder was performed in 26 cases of infiltrating tumor. Two patients were lost sight of. Of the remainder 9 died within two months of the operation and 4 more died with local recurrence within the year, a mortality of 50 per cent within the first year. Four of the remainder died with local recurrence in from two to four years and 2 are under treatment for recurrent malignancy.

From 1933 to 1938, 10 patients were subjected to partial cystectomy. Three died within two months, and 1 more before the first year elapsed; 4 more have since died of recurrence so that at the present time (1939) only 2 patients survive. The high percentage of local recurrence is clear proof that the area excised was too small.

Between 1923 and 1933, 42 cases were treated by suprapubic cystotomy and diathermy with or without radon implantation. Sixteen patients died during the first year, a certain mortality of 38 per cent. Eight patients were lost sight of in the same period, leaving 18 patients to be followed up. Five of these died of cancer and 3 of other causes without recurrence. The remaining 10 have been lost sight of.

From 1934 to 1938, 26 cases were treated with diathermy and radon through a cystotomy. Twelve patients died the first year. Two have since died of cancer and 2 have local recurrence. Five of the 26 are free from recurrence for from two to four years.

Ureterosigmoid anastomosis was performed in 18 cases with a mortality of 50.5 per cent. The method used and the number of cases were as follows:

Method	Cases treated	Deaths
Coffey II	3	2
Higgins	3	2
Coffey I	8	3

JOHN A. LOEF, M.D.

GENITAL ORGANS

Schiappapietra, T.: Spontaneous Hemorrhage of the Hypertrophied Prostate (Hemorragias espontáneas de la próstata hipertrófica). *Rev. argent. de urol.*, 1940, 9: 155.

The author first presents a classification of causes of hemorrhage in cases of hypertrophied prostate. He groups them as follows: (1) general conditions, such as (a) dyscrasias, hemorrhagic and those secondary to toxic conditions and uremia, and (b) arterial lesions with or without hypertension; (2) local conditions, such as (a) the mechanical action of large adenomas with resultant stasis, varices, congestion, pseudoangioma, trophic changes of the mucosa, and necrosis, and (b) local sepsis with congestion, suppuration, ulceration, or inflammatory proliferation; and (3) combined conditions which include both local and general factors.

The author emphasizes that the usual causes of hematuria may also occur in connection with a prostatic condition, including the result of decompression of the urinary tract. However, the author is concerned with severe acute hemorrhages in which endoscopy is frequently impossible. In such cases only cystotomy will expose the site and cause.

As concerns treatment, the author notes that in small hemorrhages simple rest, bladder drainage, and balsams are sufficient. In larger hemorrhages the clots may be aspirated and sodium citrate left in the bladder to prevent the formation of clots. In severe and dangerous bleeding exploratory cystotomy is done. Electrocoagulation is sometimes sufficient to stop the bleeding. The submucous injection of pituitrin aids in stopping the bleeding and permits the completion of a prostatectomy. Transvesical drainage through the middle lobe may initiate a hemorrhage which ceases usually on retraction of the mucosa.

The author briefly reports 6 clinical cases of prostatic conditions with hemorrhage. In most cases there was a local condition involving the mucosa. There are several photographs and x-ray reproductions in the original article. Palliative treatments are advised until the patient's general condition permits prostatectomy. JACOB E. KLEIN, M.D.

Neuhof, H., and Mencher, W. H.: The Viability of the Testis Following Complete Severance of the Spermatic Cord. *Surgery*, 1940, 8: 672.

The procedure of complete severance of the spermatic cord was employed to achieve complete

hernioplastic closure in selected cases. Of a series of 25 cases in which unilateral severance of the cord was employed, 5 were followed up inadequately and 1 had an orchidectomy soon after operation, which left 19 for consideration.

In 6 cases (32 per cent) there was obvious atrophy of the testis, in 2 cases (10 per cent) there was slight atrophy, and in the remaining 11 cases (57 per cent) the testis, according to clinical observation, remained normal. There were, therefore, 13 cases (68 per cent) in which little or no atrophy occurred.

The microscopic findings of the testicle in 1 patient undergoing an orchidectomy thirty-one months after severance of the cord, showed a reduction in the number of the seminiferous tubules. All stages of spermatogenesis were observed although the sum total was reduced. The blood vessels were unchanged. The structures of the epididymis were not unusual.

As to the technique of the operation, each structure of the cord was tied off between the external and internal abdominal rings by separate suture.

JOHN A. LOEF, M.D.

MISCELLANEOUS

Young, H. H.: Operative Treatment of True Hermaphroditism; A New Technique for Curing Hypospadias. *Arch. Surg.*, 1940, 41: 557.

The author presents his second case of true hermaphroditism. The following characteristics were noted:

The breasts were typically male. There was a complete bifid scrotum and a penis of fair size, drawn back in the scrotal cleft by a chordee. The urinary meatus was present between the halves of the bifid scrotum. The right side of the scrotum contained a well developed, apparently normal testis and epididymis. On the left side was a large reducible scrotal inguinal hernia. No testicle could be felt. A cystoscope passed easily into the bladder which was normal. As the instrument was withdrawn an opening into which the cystoscope could be introduced was found. It was evident that this was a vagina, at the upper end of which a cervix and os were visible. In repairing the left inguinal hernia after freeing and opening the sac, the author found and removed a small uterus, a fimbriated left tube and a gonad.

After the completion of the herniotomy, a plastic operation to straighten the penis was carried out; it consisted of the excision of the fibrous tissue down to and between the corpora cavernosa and the transplantation of the urethra backward into the perineum. The skin edges were then approximated. about twelve weeks later, the right testicle was exposed. It was larger than normal, the surface mottled and irregular. The epididymis did not lie in the usual position, the globus major being attached to the testicle by a thin mass of tissue 7 mm. long. Sufficient testicular tissue was removed for biopsy.

The next procedure was formation of a new urethra. An incision on the right side of about 8 mm.

Fig. 1. After opening the hernial sac on the left side, the uterus, tube, and ovary were discovered. At a second operation, several weeks later, the scrotum was opened on the left side, and the testicle and the abnormal epididymis were discovered.

and on the left of about 1.5 cm. from the midline was made to include the glans. The cut edges were approximated and inverted. The skin was then approximated with a vertical mattress suture. Healing was per primam. The penis was normal length but most of the urine passed through the perineal urethrotomy.

Three months later the perineal mucocutaneous fistula was excised, a small catheter inserted, and the tissue drawn tight around it, with the hope that when it was removed the urethrotomy fistula would close. The operation was not entirely successful and a suprapubic cystostomy was done to drain the bladder. The perineal fistula was then excised and closed in layers.

The patient was discharged. The operative result was very satisfactory. The penis was straight; urine was voided freely and in a good stream. The patient reported that he had sexual intercourse frequently. Libido was normal and erections and ejaculation were normal.

JOHN A. LOEF, M.D.

Creevy, C. D., and Rea, C. E.: The Treatment of Impotence with Male Sex Hormone. *Endocrinology*, 1940, 27: 392.

In a short report the authors review the etiological factors of impotence and summarize their article as follows:

The psychic type of impotence is the most common and difficult to treat. There is also the type due to organic disease of the nervous system; that due to local lesions of the genitalia; and that originating

from disturbances of function of the endocrine glands. Impotence on the basis of a deficiency of a natural testicular hormone has been demonstrated to respond satisfactorily to testosterone.

The writers treated 12 patients complaining of impotence who had no evidence of hypogonadism over a period of three years. The patients ranged in age from twenty-seven to sixty years. Two had undescended testes; 2 had had a posterior excision of the rectum for cancer; 2 had chronic prostatitis; while 6 had no demonstrable disorders. Eight were completely impotent; 3 complained of inability to have intercourse more than occasionally; and 1 had premature ejaculation. The treatment consisted of the intramuscular injection of from 10 to 25 mgm. of testosterone propionate three times a week for eight or more injections. While most of the patients felt less depressed mentally there was no improvement in the impotence. RULON W. RAWSON, M.D.

Culp, O. S.: The Treatment of Chancroid with Sulfanilamide. *Am. J. Syph., Gonor. & Ven. Dis.*, 1940, 24: 622.

A review of the literature on the use of sulfanilamide in chancroid, and an additional series of 35 cases is presented by the author. All of the patients were cured on an average daily dose of at least 60 gr. of the drug and no recurrences were noted. The average time required to cure all patients in this series was thirteen days, and the author concludes that sulfanilamide given orally is the most effective and convenient means of treating chancroids.

D. E. MURRAY, M.D.

Greenblatt, R. B.: The Newer Venereal Diseases. Their Association and Confusion with Neoplastic Disease. *Am. J. Surg.*, 1940, 49: 411.

The purpose of this article is to draw attention to the frequency with which genital malignancy is confused with venereal disease. The author cites cases of malignancy as a sequel to venereal disease, malignancies mistaken for venereal disease, and neoplasia of venereal origin. In his discussion of the topic and in the cases cited, he stresses the value of biopsy, since the positive blood Wassermann reaction or the Frei tests in themselves may stand in the way of a true diagnosis of a malignant process being made. Proper histological study may reveal treponema pallidum or the pathognomonic cell of granuloma inguinale, or it may suggest the diagnosis of chancroid disease or lymphogranuloma venereum. It is demonstrated by an analysis of the cases reported that a positive Wassermann or a positive chancroid or Frei test does not necessarily reveal the lesion in question, and that biopsy may prove a resourceful undertaking. JOHN A. LOEF, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Phemister, D. B.: Changes in Bones and Joints Resulting from the Interruption of Circulation. General Considerations and Changes Resulting from Injuries. *Arch. Surg.*, 1940, 41: 436.

Necrosis in bone resulting from aseptic interruption of the circulation is discussed together with repair of this necrosis. The first information of this process was obtained by a study of bone transplants, and then it was recognized that certain epiphyseal disturbances, such as Legg-Perthes disease, were really necrosing lesions. Certain fractures bordering on joints and dislocations may cut off the blood supply and cause necrosis of the ends of the bone. Pathological and roentgen studies of the reactions of the surrounding living bone to necrotic bone have been made. A zone of fibrous tissue forms about the necrotic focus and gradually invades the dead bone. The outer edge of this fibrous zone becomes transformed into an advancing osteogenetic zone and as this advances the necrotic area is repaired; in some cases, particularly in the shafts of bones of adults and in the head and condyles of the femur, the necrotic area may be incompletely removed. Function to some extent aids this process, but if there is too much weight-bearing there may be a fracture of the weak new bone with possible collapse of the articular portion.

The nutrition of the cartilage may be interfered with and if the replacement of the underlying bone is delayed for longer than twelve months the cartilage is apt to die and a chronic deforming arthritis develop. There is enough of the living bone in one or two months to cause it to cast in the roentgenogram a shadow fainter than that cast by the dead bone which keeps its original density. The substitution by new bone then again alters the density so that these changes are well studied with the roentgen rays.

Traumatic interruption of the circulation of bone is most frequently caused by fracture. There is a small amount of necrosis of the fragment ends in almost every case of fracture, but it undergoes creeping substitution with the healing of the fracture. If the fracture is comminuted the broken-off pieces may undergo partial or complete necrosis, and creeping replacement is gradually accomplished; but if the fragment is too large the necrosis may be a factor in non-union, and a case is cited in which an onlay graft was necessary to get union. There is often a good deal of aseptic necrosis to be observed on microscopic examination of the ends of the fragments resected at operation for ununited fracture.

Necrosis of the body of the astragalus following fracture of the neck is reported, and a fracture case is reported in which resection of the astragalus was necessary because of failure of creeping substitution. Fracture of the carpal navicular bone often results in severance of the blood supply and necrosis of the proximal fragment; if non-union results in the presence of necrosis there is usually much functional disability. The head of the radius and the lower articular surface of the humerus are often fractured within the joint, but interruption of the blood supply of the head of the femur produced by intracapsular fracture is by far the most important lesion of this sort. In case of death of the head from injury to the circulation, the fracture may either unite or remain ununited. If the fracture unites, provided weight-bearing is avoided for many months, there may be sufficient creeping replacement by new bone to prevent subsequent collapse of the head. Necrosis of the head associated with non-union has been studied at all stages. Where the head has in some portion undergone creeping substitution, insertion of bone grafts and wires for fixation is at times extremely satisfactory, and such a case is appended. Dislocation of the hip may result in interruption of the blood supply and necrosis of the head of the femur, and dislocation of the carpal lunatum is often responsible for its necrosis. A note of caution is sounded in that one must carefully consider the blood supply of the head of the femur and not excise the capsule of the neck while doing an arthroplasty of the hip joint.

HAWTHORNE C. WALLACE, M.D.

Voznesensky, V. P.: Discussion of Methods of Treatment of Acute Hematogenous Osteomyelitis. *Nov. khir. arkh.*, 1940, 46: 22.

Observations on 414 cases of acute hematogenous osteomyelitis in children, combined with a study of the modern literature, lead the author to the following conclusions:

Cases of acute osteomyelitis may be divided into two groups. In the first, the process leads to the formation of one or a few circumscribed, isolated sequestra; the lesion presents itself in the form of a local necrosis of a relatively small portion of bone, with a marked reaction of the surrounding normal osseous tissue. In such cases an expectant treatment is fully justified and surgical procedures, if necessary, are limited to sequestrotomy. In the second group, a diffuse osteonecrosis involves the entire bone, without a circumscribed osseous demarcation, or nearly the entire bone at once forms a sequestrum. This group is smaller than the first. As to the treatment, radical procedures, without any compromise, are indicated. Expectant treatment in such cases is time-consuming and the dressings are painful; furthermore, the ultimate results are poor as the involved extremity is usually deformed, the patient becomes exhausted, the process may show a tendency to generalization, and various complications, such as dislocation, may follow. The author advocates a secondary early subperiosteal resection of the involved portion of the

bone. The term "secondary" is applied to the operation because it follows a primary incision of the subperiosteal abscess. The latter is an emergency operation, similar to a tracheotomy in a stenosis of the glottis. The secondary operation is performed as soon as the diagnosis of a total sequestration of the bone or a diffuse osteonecrosis without a localized sequestrum has been made. As a rule, the resection can be planned three or four weeks after the primary incision because structural changes in the bones cannot be detected roentgenologically before that time. Furthermore, one month after the primary incision the patient has usually recovered sufficiently from the acute attack of osteomyelitis.

A differentiation of both groups of osteomyelitis is not always easy and is based chiefly on roentgenological findings. The resection should be extensive in order to remove the entire affected area and to liberate the periosteum from the harmful effects of the pathological process.

The danger of formation of a pseudarthrosis is more hypothetical than real.

The advantages of the method advocated by the author are particularly noticeable in regions where two bones are present, viz., forearm and lower leg. The time required for treatment is shortened, the danger of generalization of the process is minimized, and complications can be avoided in the majority of cases. The regenerated bone, as a rule, assumes its normal anatomical shape.

The average duration of treatment was from one to two months. JOSEPH K. NARAT, M.D.

Hultén, O., and Gellerstedt, N.: Products of Wear and Tear in Joints. Their Resorption; Synovitis Detritica (Ueber Abnutzungsprodukte in Gelenken und ihre Resorption unter dem Bilde einer Synovitis detritica). *Acta chirurg. Scand.*, 1940, 84: 1.

It has been known for some decades that articular cavities rid themselves of certain particles of foreign substances and of clotted blood originating from intra-articular hemorrhage by moving them into "quiet" corners of the joint where they are slowly absorbed. It also has been known that there is a constant wear and tear of the cartilaginous linings of the joints normally, and to an increased extent after extreme use in hard work and in certain diseases. The products of this wear and tear are small particles of cartilaginous substance. This article is concerned with the fate of these products.

While Frerich and Hammar assume that such small bone and cartilage particles are dissolved by autolysis, this was not the case in Hultén and Gellerstedt's experiments. The latter kept suspensions of minute cartilage particles in saline solution at body temperature for months and found only an occasional area of liquefaction.

The authors obtained sterile suspensions of minute cartilaginous particles by scraping either rib cartilage or joint cartilage removed from experimental animals. These suspensions were injected into knee joints of either the donor animal or another of the same species or into different animals (rabbits and guinea-pigs). Control injections of normal saline solution were always given simultaneously into the other knee joint.

The injected particles always moved either into the suprapatellar pouch or into the posterior pouch, which was analogous to the behavior of foreign substances in the studies made by former investigators. These particles disappeared rather fast from the suprapatellar region and slowly from the posterior pouch. Smaller particles were incorporated into the synovial membrane by phagocytosis, larger ones by synovial cells which grew around them. If larger conglomerates were incorporated in the synovial membrane the resulting lump was too large to be leveled in the synovia; it could be torn loose by the movements of the joint and thus led to the formation of a loose body. The synovial membrane responded to the presence of minute pieces of cartilage, not by the extravasation of leucocytes, but by hyperemia and increase of the histiocytes. After cessation of the irritation the number of histiocytes decreased again, but there remained an increase of synovial connective tissue. After repeated administration of cartilage detritus, the picture of a fibroplastic synovitis sometimes resulted, which the authors call synovitis chondrodetritica. This is a common finding in all articular diseases with much cartilage disintegration, such as chondromalacia patellæ, osteochondritis dissecans, arthritis deformans, and intra-articular fractures. Its subjective importance results from the fact that it produces pain. Rest reduces the formation of minute cartilaginous particles in a diseased joint, and even after a few days of rest the acute stage of cartilage digestion is over.

In certain conditions such as chondromalacia patellæ, excision of the cartilage, which is subject to increased disintegration, has been done with success. According to the authors, this result is due to eradication of the source of cartilage detritus. The authors suggest that analogous situations may occur after trauma, and in arthritis deformans, in which instances increased detritus formation may be assumed to be the cause of the articular symptoms.

HEINRICH LAMM, M.D.

Garavano, P. H.: A New Technique for the Transplantation of the Trapezius Muscle in Isolated Paralysis of the Deltoid Muscle (Nueva técnica para el transplante del músculo trapecio en la parálisis aislada del músculo deltoides). *Rev. de ortop. y traumatol.*, 1939, 9: 26.

The fixation of the shoulder joint for the treatment of simple deltoid paralysis means the sacrifice of a very important joint and condemns very valuable muscles to atrophy. Therefore, a number of authors have proposed different means to overcome the deltoid insufficiency by demanding of other muscles the function of the absent one. Hildebrand and Bastos Ansart employed the clavicular portion of the pectoral muscle; Lange united the trapezius

muscle to the deltoid "V" with a silk tendon; Spitzy transplanted both the trapezius and the pectoralis muscles. Leo Mayer lengthened the trapezius muscle with a fascial flap.

The author has tried this last method, but he believes that it very often fails because:

1. The fascial tendon must be implanted in the trapezius and in the humerus, which demands time and immobilization. Any movement under 90 degrees of abduction during the three or four weeks following the operation may produce failure. The passive elongation of the tendon through the simple action of the weight of the limb is also very important.

2. The acromial bridge is the most serious obstacle to the sliding of the fascial tendon because of the adhesions which occur in almost every case. In time the bridge becomes adherent to the tendon and the trapezius muscle reassumes its insertion in the acromion. In many cases which are considered successful only abduction of the scapula by the action of the trapezius muscle and not an active abduction of the shoulder joint has been effected.

The author's technique is as follows:

1. The transformation of the acromion into a sesamoid insertion of the trapezius, fixed directly or indirectly on the humerus and thus preserving the natural attachments of this muscle.

2. The acromial sesamoid insertion is made by posterior resection of the spine of the scapula and anterior resection of the lateral quarter of the clavicle, outside of the thoracoclavicular ligament.

3. The trapezius can function freely and without the obstacle of any channels or bridges which may cause adhesions and a new insertion of the muscular transplant.

The operation must not be performed unless the muscles are strong and the movements of the joint are free. If the muscles are not strong enough, it is better to produce an arthrodesis.

The best incision is one which starts in the base of the spine of the scapula, curves around the acromion, and ends on the clavicle. The flaps must not be dissected extensively and the surgeon must try to lift a block of skin, subcutaneous tissue, and of the trapezius to overcome the tendency of the muscle to adhere to the scar tissue. The spine, the acromion, and the clavicle are freed and the deltoid is loosened from the bone subperiosteally. This must be done with the knife and never with the periosteal elevator. The same maneuver is made with the trapezius, from the base of the spine to the clavicle, but the portion inserted on the acromion is left attached.

With a thin bone chisel the acromion is cut at its base; the base of the spine is cut also. In this way the trapezius is freed of all its posterior insertions.

With the dissecting knife the surgeon cuts the coraco-acromial and acromioclavicular ligaments. The acromion is raised and the trapezius is inverted; the latter is then dissected in its deep layer from the underlying tissue. The remaining part of the clavicle is resected and now the trapezius is attached to the humerus. This is the most difficult part of the operation and as the force exerted by the arm between the abduction and the normal position is very important, the fixation must be done very carefully. A square recess is made with a thin chisel on the tuberosity of the humerus just lateral to the insertion of the supraspinatus tendon. The acromial transplant with the attached trapezius is applied in this recess and is fixed with a suture of chromic catgut. From this moment on the abduction must be carefully maintained. After the usual sutures a plaster-of-Paris cast is applied, with the arm in 90 degrees of abduction. After from twenty-five to thirty days of immobilization exercises are started.

The author has had gratifying results in 2 cases and hopes that his method will prove useful in the hands of other surgeons. HECTOR MARINO, M.D.

Ferguson, L. K., and Thompson, W. D.: Internal Derangements of the Knee Joint. *Ann. Surg.*, 1940, 112: 454.

In this review of 100 cases of internal derangement of the knee, the authors point out the relative frequency of the various lesions which fall under this general diagnosis; detail the symptomatology upon which the diagnosis and operative indications

Fig. 1.

Fig. 2.

Fig. 1. Adhesive strapping for the early treatment of internal injury to the knee joint. After aspiration of the effusion, a crisscross strapping is applied beginning well laterally and as high as possible on the thigh, extending downward across the lower leg at the knee. Several succeeding layers are applied using 2 in. adhesive. The straps are anchored above and below by circular turns of elastoplast bandage.

Fig. 2. Strapping the internal injury to the knee joint. The strapping is completed by the application of a firm elastic bandage at the knee.

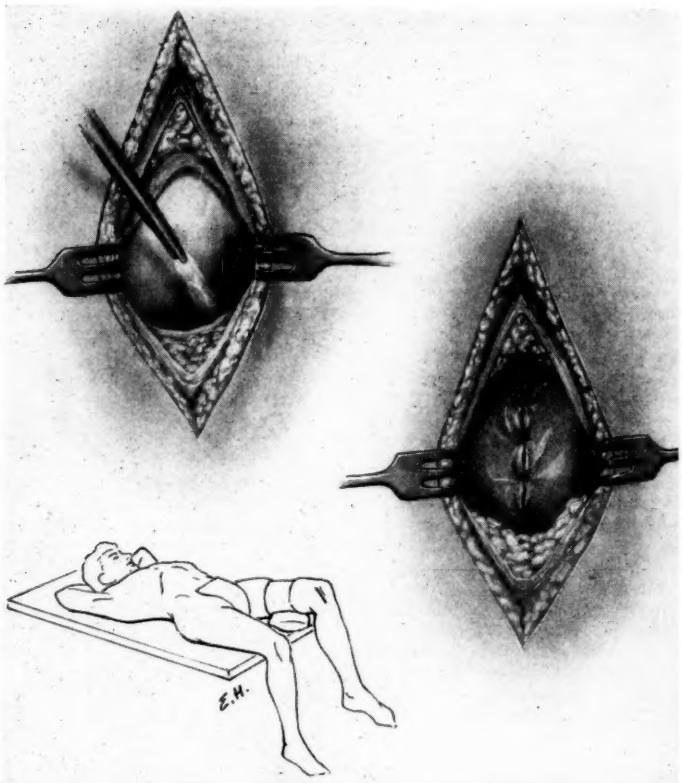


Fig. 3. Upper drawing: Case showing a dog-eared tear of the anterior portion of the cartilage. In 7 patients only this torn portion of the cartilage was removed. Good results were obtained in all instances.

Middle drawing: Showing method of loosely suturing the capsule of the joint with interrupted sutures. The loose suture permits escape of joint effusion and so prevents secondary effusions of the knee after operation.

Lower drawing: Showing position of the patient on the table, sand-bag under the knee, and tourniquet on the thigh. It is to be noted in these drawings that the wound covers, which are clipped to the skin edges with Michel clips, have been omitted. (Courtesy of J. B. Lippincott Co.)

are based; and give the follow-up results obtained in 95 of the 100 cases. In addition, the operative technique and plan of after-care is described, as well as the operative complications which have appeared. Also, the anatomy of the knee joint is described, as well as the mechanism of the injury. This injury is usually caused by an indirect torsion of the femur on the tibia with the knee in partial flexion. Eighty-two per cent of the patients were males and in more than one-half of the cases the injury occurred as an accident of competitive sports.

Longitudinal tears (bucket handle) of the internal cartilage were the most frequent injury (31 per cent). Removal of the cartilage resulted in the normal knee in 28 of 29 cases followed up. Tears of the anterior portion of the cartilage were found in 18 patients; there were 16 cases followed up; all of the patients have normal knee function.

The results were equally good with partial or complete excision of the cartilage. Tears of the midportion of the cartilage occurred in 10 patients: in 8 cases which were followed up the patients have normal knee function after excision of the cartilage; 1 has slight limitation of flexion, and 1 has occasional catching and effusion. Posterior tears of the semilunar cartilage occurred in 6 patients: 5 have good function of the knee after removal of the torn cartilage; 1 has a poor result because of definite

relaxation of the ligaments of the knee. Abnormal looseness of the internal semilunar cartilage was found in 13 patients. In most of these cases there was also hypertrophy of the infrapatellar fat pad. Excision of the internal cartilage, with or without excision of the hypertrophied fat pad, was performed. In 10 cases the knee function is normal. In 3 cases, in which the fat pad was not excised, there is a slight residual disability. Hypertrophy of the infrapatellar fat pad was found in 16 cases. In 10 of 15 cases followed up, the patients have normally functioning knees and 5 have occasional disability on twisting the knee. In two of the good results the fat pad was not excised. Injuries to the anterior crucial ligament occurred in 4 cases. In only 1 of these was an attempt made to repair the ligament; good results were obtained in all cases. Osteochondritis dissecans or foreign bodies were found in 5 cases: 4 of these have good results; 1 patient has slight residual disability.

Except in a few patients, who came in with a knee locked in partial flexion, operation was advised as primary treatment. Aspiration of the knee and application of a dressing which permits fixation and function has been the practice of the authors, which was varied with the apparent severity of the injury. In the milder injuries fixation was obtained by crossed adhesive strapping, held at the knee by an elastic bandage. In the more severe cases a plaster-of-Paris splint was used in some instances, and, more recently, a castex case was applied from the ankle to the gluteal fold. If after a thorough trial at conservative therapy there were frequent recurrences of knee disability, operative intervention was indicated. EMIL C. ROBITSHEK, M.D.

Cederlund, H.: Two Cases of Intra-Articular Xanthoma of the Knee-Joint (Zwei Faelle von Intraartikulaerem Xanthom im Kniegelenk). *Acta chirurg. Scand.*, 1940, 84: 143.

The first of the 2 cases of intra-articular xanthoma of the knee-joint reported occurred in a girl aged thirteen, who had suffered no trauma to the knee. In August, 1938, she began to complain of pain in the right knee after exertion, and noticed swelling and tenderness. Occasionally she was unable to straighten the knee after bending, and sometimes she felt round firm nodules on the lower border of the patella. When admitted to the hospital, a slight swelling of the joint and the nodules mentioned were found. The general examination and the roentgen-ray study were negative. At operation under local anesthesia Cederlund removed a mass, 9.5 by 4 by 1.7 cm., which was attached to the synovial membrane by a small pedicle. It had filled a transverse space behind the patella on its lower border, and after its removal both of the protuberances mentioned were gone.

Histological examination of the mass showed giant cells and led to the diagnosis of a xanthoma. There was no malignancy. Examination about a year after operation showed no recurrence. The blood cholesterol was found to be normal at this time.

The second case was that of a woman thirty-six years of age. At the age of thirty-two she had bumped her left knee slightly against a door. This was followed by swelling and slight pain which persisted for some months. After subsidence of the swelling she noticed a nodule on the medial and lower margin of the patella. This grew slowly, and there was increasing difficulty in flexing the knee-joint. There was an occasional locking of the joint in both flexion and extension.

Examination on admission was negative except for a slight fever and a moderate hydrops of the left knee-joint. A nodule was felt as a firm movable body of bean size, medial to the apex of the patella. There was a slight tenderness of the medial articular cleft and marked pain on movement in the knee-joint. Arthrotomy under local anesthesia revealed a marked increase of the synovial fluid and a tumor attached by a pedicle to the fossa intercondyloidea femoris. The pedicle was severed and the joint closed. Histologically, a fibrosarcoma-like tumor was found which contained a large amount of lipoid in foam-like xanthoma cells which gave it a butter-like appearance. The diagnosis of articular xanthoma was made. The recovery was uneventful. The blood contained 285 mgm. of total cholesterol per 100 c.cm., and 74 mgm. of free cholesterol.

The first case of xanthoma was reported erroneously as a sarcoma in 1865. Since then some 40 cases have been reported. They are about evenly distributed between the two sexes. The signs and symptoms are:

1. A palpable or visible tumor, usually hard and medial to the apex of the patella. Two or more tumors may mean multiple xanthomatosis, but not necessarily, as the author's second case shows.
2. Pain.
3. Hydrops.
4. Functional disturbances, as locking or impairment of flexion or extension. Roentgen-ray examination was negative in all reported cases of solitary xanthoma, but in cases of diffuse xanthomatosis, bone atrophy and a reduction of cartilage were seen.

Recently the increased blood cholesterol level (normal values: from 160 to 180 mgm. per 100 c.cm.) has been considered as a characteristic sign, but it is increased in only about half of the cases.

Except for 1 case of recurrent xanthoma, the diagnosis of xanthoma never has been made before the operation. The pre-operative diagnosis usually is a loose body, torn meniscus, lipoma, or osteochondroma.

The prognosis is good and there are no reports of metastases. Recurrences are rare and are supposed to originate from small tumor rests which had not been removed on operation.

The treatment is surgical removal of the tumor.

Pathologically, the xanthoma of the joints resembles the xanthoma of the tendons and tendon sheaths, of fascia and ligaments, and also the epulides and brown giant-cell tumors in osteitis fibrosa localisata.

It is doubtful whether xanthomas are true neoplasms; many authors believe them to be of inflammatory origin, i.e. granulomas, and they consider the coincidence of trauma and a disturbance of the cholesterol metabolism as essential for their formation. However, both trauma and disturbance of the cholesterol metabolism have not been found constantly or even frequently enough to support such a theory. HEINRICH LAMM, M.D.

Conway, F. M.: Rupture of the Quadriceps Tendon, with a Report of 3 Cases. *Am. J. Surg.*, 1940, 50: 3.

Rupture of the quadriceps-extensor apparatus can occur by direct or indirect violence and may occur in the suprapatellar or infrapatellar region. McMaster's clinical conclusions, based on experimental animal studies, were that when a normal muscle-tendon system is subjected to severe strain, the tendon does not rupture. However, rupture may occur (1) at the insertion of the tendon to bone; (2) at the musculotendinous junction; (3) through the belly of the muscle; and (4) at the origin of the muscle from the bone. Either the muscle or the tendon may avulse a small fragment of bone, and sometimes the strain results in fracture or dislocation. Disease processes in tendons predispose to their "spontaneous rupture" often from only slight strain, as in tendons affected by (1) tuberculous tenosynovitis (2) gonococcal tenovaginitis, and (3) trichinosis, typhoid, syphilis, or tumors. Rupture of muscle fibers occurs following both direct and indirect types of trauma. Degenerative changes and disease processes in muscles predispose to rupture. Slight to more extensive muscle ruptures occur following varying degrees of direct or indirect trauma and are often overlooked in clinical cases. Quilichini indicates that almost all the traumatic ruptures of the quadriceps due to indirect violence occur as a result of pure muscular contraction following such forced movements as are employed in the effort to avoid an impending or imminent fall. Ordinarily, the muscular contraction is very violent and usually a misstep or attempt to regain one's balance is made following an effort to avoid a fall. This produces a rupture of the extensor apparatus and the fall then occurs as a result of the rupture. Rupture may occur also from a fall with the leg flexed on the thigh.

The pathognomonic physical sign of suprapatellar rupture of the quadriceps tendon is the absence of the fullness of the quadriceps pouch. This concavity or depression varies in depth with the extent of the rupture. It is only slightly marked if the anterior portion of the rectus femoris alone is torn. With an extensive laceration of the lateral expansions of the vasti muscles, one can visualize the superior aspect of the femoral condyles. The pathognomonic sign of complete infrapatellar ruptures is the shift upward of the patella. Hemarthrosis of the knee joint indicates that the injury has involved the synovial lining of the joint cavity. In old cases in which the disability has existed for a long time, the symptoms and signs are again dependent upon the type of rupture and the extent of the accompanying tissue damage. There is inability to extend the knee, with consequent decrease in power to climb any incline, and lack of stability in ordinary walking. This disability varies with the extent of muscle and tendon retraction and quadriceps atrophy.

Three operative cases are cited, 2 of which are suprapatellar ruptures and the third is an infrapatellar rupture with avulsion of the anterior tibial tubercle. The author reports that excellent results followed early operative repair.

F. HAROLD DOWNING, M.D.

McElvenny, R. T., and Thompson, F. R.: A Clinical Study of 100 Patients Subjected to Simple Exostosectomy for the Relief of Bunion Pain. *J. Bone & Joint Surg.*, 1940, 22: 942.

Exostosectomy relieves bunion pain by removing the projecting medial portion of the first metatarsal head. It does not correct the hallux valgus.

Under local or general anesthesia, a 2 in. dorsomedial incision is started ½ in. distal to the first metatarsophalangeal joint. This incision is carried proximally in a gentle curve, it passes above the dorsal outline of the bursal sac and thence straight up the metatarsal shaft. The dorsal vein is preserved. The bursal sac is excised if it contains calcareous material, is nodular, or is greatly thickened, but otherwise it is left intact. The capsule is incised in line with the skin incision. The joint space is located and the knife inserted between the medial side of the capsule and joint space. The knife is kept close to the metatarsal head while it separates the capsule from the bone for a sufficient distance to expose the entire medial side of the metatarsal head and a small portion of the adjacent shaft. The amount of bone to be removed is determined from the gross appearance of the metatarsal head. The osteotome is placed on the metatarsal head parallel to the vertical axis of the metatarsal shaft and is pointed slightly medially. It is then driven through the bone which removes that portion of the metatarsal head that does not function as articular surface. The bone is inspected, sharp edges are rounded off, and all loose pieces of bone are removed. The wound is closed in layers. The toe is bandaged to hold it in a varus position with slight plantar flexion. Active toe motion is encouraged. Sutures are removed on the tenth day and the patient is allowed up in comfortable shoes. Physical therapy is given in the form of foot and toe exercises, massage, and contrast foot baths.

The 100 patients in the group operated upon were examined by the authors from nine months to six years after operations. Seventy-seven were entirely relieved of all bunion pain and discomfort. Eleven had vague aches and pains about the first metatarsophalangeal joint which suggested arthritis. No absolute cause for their discomfort could be determined. All 88 were considered to have satisfactory results because they were pleased with the operation and would recommend it to others.

The remaining 12 patients presented disappointing results. Eleven had both feet operated upon. Of 23 of these, 19 were painful. The cause of pain and disability following operation was due either to a faulty selection of cases or to some fault in operative procedure.

From the study, it is believed that a patient should fulfill the following requirements:

1. The patient should be interested primarily in the relief of bunion pain, not in correction of the deformity.
2. Circulation in feet must be adequate.
3. Sesamoiditis should not be present.
4. The great toe movement at the first metatarsophalangeal joint should be free and painless.
5. Hallux valgus should be under 50 degrees when estimated by the angle which the great toe subtends with the metatarsal shaft.

The operative faults encountered were:

1. Failure to remove loose bone spicules.
2. Inadequate removal of the medial portion of the metatarsal head which results in persistence of the bunion.
3. Too generous removal of the medial sides of the metatarsal head which allows pain because of shoe pressure on the prominence of the base of the first phalanx of the great toe.
4. Inadequate removal of the side of the metatarsal head which leaves a cortical ridge on the medioplantar border of the head and persisting pain.

PAUL C. COLONNA, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Lapidus, P. W.: Dorsal Bunion; Its Mechanics and Operative Correction. *J. Bone & Joint Surg.*, 1940, 22: 627.

The term "dorsal bunion" is suggested for a pathological condition of the big toe consisting of a plantar-flexion contracture at the metatarsophalangeal joint with a more or less pronounced dorsiflexion contracture of the first metatarsal at its articulation with the cuneiform bone. The deformity may occur in four types of cases:

1. Hallux rigidus
2. Flaccid and spastic paralytic deformities
3. Congenital club-foot
4. Severe congenital talipes planovalgus.

The following surgical procedure has been devised by the author for correction of the "dorsal bunions:"

The dorsal exostosis of the first metatarsal head is removed through a dorsomedial incision. In exposing the metatarsal head the dorsal capsule is turned up as a tongue-shaped flap with its base attached to the phalanx. Through another incision on the dorsomedial aspect of the foot, the first cuneiform metatarsal joint is exposed. In cases in which overactivity of the tibialis anterior is a factor in the production of dorsiflexion deformity of the first metatarsal, this tendon is transferred backward into the insertion of the tibialis posterior. The fixed dorsiflexion contracture of the first metatarsal is overcome by a wedge-shaped resection with plantar base performed through the first cuneiform-metatarsal joint. If necessary, a similar resection is also done through the first cuneiform-navicular joint.

The action of the flexor pollicis longus tendon is then changed from that of a toe flexor to one of flexion of the first metatarsal. This is accomplished by detaching this tendon at its insertion and transplanting it through an oblique tunnel drilled in the metatarsal. Plantar capsulotomy and tenotomy are performed under the metatarsophalangeal joint. In suturing the initial incision over the big-toe joint, the dorsal flap is transferred proximally on the first metatarsal to help maintain the basal phalanx in the extended position. Plaster immobilization is maintained about two months.

DANIEL H. LEVINTHAL, M.D.

Garceau, G. J.: Anterior Tibial Tendon Transposition in Recurrent Congenital Club-Foot. *J. Bone & Joint Surg.*, 1940, 22: 932.

In the cases of club-foot reported, recurrence of the deformity occurred in spite of vigorous conservative treatment by manipulation, casts, club-foot braces, and 36 operations including: arthrodesis (4), decancellation of the calcaneum (3), Hoke operation (1), Ober operation (2), Brockman operation (3), osteotomy of the talus (1), Achilles tenotomy (16), fasciotomy (4), and capsulotomy (2). Forceful wrenchings, resulting in stiffening of the tarsal joints, had previously been done on at least half of the patients.

On examination it was found that when active dorsiflexion of the foot was attempted the foot was supinated. The anterior tibial tendon, inserted at the first cuneiform bone and base of the first metatarsal, pulled the whole foot into inversion, and exaggerated the inversion of the os calcis. This occurred with each step.

In every instance the strength of the peroneal muscles was not sufficient to evert or pronate the foot actively. In no patient had the inversion of the os calcis been completely corrected, and some degree of deformity in each component had recurred.

The average age of the patients was six and one-half years. Three were in their third year, and 2 in their sixteenth.

The operation consists of transferring the anterior tibial tendon insertion to the proximal end of the fifth metatarsal where it is anchored by passing it through a drill hole in the metatarsal and fixing it with a silk suture to the periosteum or to the soft plantar tissues. A circular plaster cast is applied, maintaining as much correction of the deformity as possible. Every two weeks the cast is removed and a fresh wedge-cast applied. Postoperative casts were worn for an average of eight weeks.

Transplantation of the anterior tibial tendon was performed on 56 feet in 44 patients. The influence of the operation of the adduction of the forefoot was

graded excellent in 19 feet, or 34 per cent; good in 24, or 43 per cent; and not satisfactory in 3, or 5 per cent. The effect on the adduction was not noted in 10 feet, or 18 per cent.

The effect on the inversion was excellent in 30 feet, or 54 per cent; good in 22, or 39 per cent; and had no apparent effect in 4, or 7 per cent.

It was difficult to evaluate the effect of the operation alone on the equinus, because wedge casts were applied for an average of eight weeks after surgery. The final end-result was influenced remarkably by the degree of equinus present before the operation. Correction of the equinus is essential. In 3 instances, a tibial-turn operation was subsequently performed to correct the torsion of the tibia, with excellent results.

The indications for the operation are simple. If deformity recurs after vigorous conservative treatment, the mechanism of the anterior tibial tendon should be determined. If, on active dorsiflexion, the foot is inverted and the forefoot is adducted, this operation should be contemplated. If the peroneal muscles cannot evert the foot, the operation is indicated.

F. HAROLD DOWNING, M.D.

FRACTURES AND DISLOCATIONS

Bértola, V. J.: Recurrent Dislocation of the Shoulder; Coracoglenoid Osteoplastic Bridge. Operation of Ricardo Finochietto (Luxación recidivante de hombro; puente osteoplástico córacoglenoideo. Operación de Ricardo Finochietto.) *Rev. de med. y ciencias afines*, 1940, 2: 545.

Bértola uses the principle of Finochietto's intervention to prevent the recurrence of dislocation of the shoulder: a coracopreglenoid osteoplastic bridge is installed to retain the humeral head in the glenoid cavity. A costal graft, 7 cm. long, is taken, usually from the fifth rib; one extremity is sharpened and perforated for the passage of a supporting suture and the other extremity is flattened to allow it to fit easily into the pocket cut in the external border of the scapula, if this variation of the intervention is used. The patient is then placed in dorsal decubitus with the arm in slight abduction and external rotation and the forearm in supination; a combination of local and regional anesthesia is employed. The incision is made along the deltoid pectoral groove from the depression of Morenheim to the junction of the lower border of the deltoid with the beginning of the external bicipital groove. The deltoid and large pectoral muscles are separated and retracted, with the cephalic vein resting on the deltoid. The coracobrachial and small pectoral muscles are separated and retracted, which exposes the subscapular muscle. The lower aspect of the horizontal portion and the anterior aspect of the vertical portion of the coracoid process are denuded by means of Finochietto's curved elevator and two or three perforations are made through the midline of the coracoid process to facilitate its subsequent osteotomy (Kirschner wires are used for this purpose). The coracoid process is sectioned lengthwise with a chisel so as to obtain a V separation of ½ cm. between its two halves. A pocket large enough to receive the lower extremity of the costal graft is made in the subscapular muscle, 2 cm. below the border of the glenoid cavity and close to the axillary border of the scapula (Fig. 1). The graft is passed from above through the V separation of the coracoid process and slipped down until it rests in the pocket of the subscapular muscle (Fig. 2); a No. 2 chromicized catgut suture introduced through the perforation previously made near the border of the upper extremity of the graft is passed round the coracoid process and, when tied, carries the graft inward and forces it down into the pocket of the subscapular muscle. If necessary, a suture is placed on the pocket, and the various planes are reconstructed separately. The arm is kept immobilized against the chest for forty days by means of a plaster cast.

The author describes two variations of this intervention. In the first, after separating the deltoid and large pectoral muscles, he dissects the external border of the coracobrachial and retracts it internally, uncovering the tendon of the subscapular muscle, the upper and lower borders of which are dissected. He sections the muscle 1 cm. from its

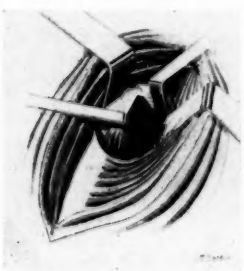


Fig. 1.

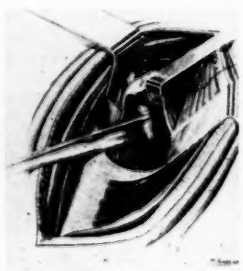


Fig. 2.

Fig. 1. The broken line shows where the pocket is to be made in the subscapular muscle.

Fig. 2. Insertion of the graft into the pocket.

Fig. 3.

Fig. 4.

Fig. 3. Wedge-like cut in the axillary border of the scapula.

Fig. 4. Position of the graft.

insertion and examines the articular capsule to correct relaxations or diverticula if necessary. He retracts the subscapular muscle and exposes the axillary border of the scapula into which he makes a wedge-like cut, 1 cm. below the capsular insertion and 1 cm. wide (Fig. 3), to receive the lower extremity of the graft which is otherwise implanted in the same manner as in the first operation. The subscapular muscle is then sutured to cover the graft, and the various planes are reconstructed.

In the second variation, the graft is given the same double osseous support, but the incision of the skin is made in a line from the coracoid process to the intersection of the mammillary line with the projection of the third rib, and the skin flaps are mobilized until the lower border of the clavicle and lower border of the large pectoral muscle and part of the deltoid muscle are exposed. In this case, the axillary border of the scapula is reached by separating the fibers of the subscapular muscle and the graft is installed through this opening (Fig. 4).

RICHARD KEMEL, M.D.

Murray, R. C.: Fractures of the Head and Neck of the Radius. *Brit. J. Surg.*, 1940, 28: 106.

Fractures of the head and neck of the radius are the most common fractures involving the elbow. The author's article is based upon 459 cases studied between 1927 and 1937. The total number of fractures of the head or neck of the radius which were encountered over this period was 722. This number represents an incidence of 44 per cent of all elbow fractures and 4.5 per cent of all fractures treated at the Liverpool Royal Infirmary. In none of the cases investigated was the fracture compound. Fifteen per cent were complicated by the presence of other injuries to the elbow, forearm, and wrist. The majority of neck fractures occur in children and the older the patient, the greater the injury is likely to be.

The majority of the fractures of the head and neck of the radius result from indirect violence, the head being crushed against the capitellum. If this view is correct, the so-called falls on the elbow are actually falls on the bent forearm resulting in forcible abduction and flexion at the elbow joint.

In the author's series of 459 cases, 401 (87 per cent) were treated conservatively and 58 (13 per cent) by operation.

Conservative treatment. In most cases all that is necessary is rest of the elbow in full flexion in a collar-and-cuff sling for from ten days to three weeks, according to the severity of the lesion. In complicated fractures full flexion may not be possible at once on account of swelling, but in the other types swelling is usually negligible. Flexion may also be limited by a displaced fragment, but such a fracture would rarely be treated conservatively. In simple cracks without displacement gentle active movements both of rotation and of flexion and extension are allowed from the start, the sling being discarded in from ten days to two weeks. In marginal fractures it is wiser not to allow any movement for ten days, and the same is true for greenstick fractures of the neck. Comminuted fractures, depressed marginal fractures, adult fractures of the neck and most complicated fractures require three weeks' rest in full flexion before movements are started. In all cases active exercises of the hand, wrist, and shoulder are insisted on from the start. In some of the early cases of this series massage and passive movements were employed about the stage when the sling was discarded, but these were found to delay recovery and were abandoned as harmful. Manipulation was carried out in a few cases of displaced marginal fragments with relatively little success, but more often for fractures of the neck with angulation. In the latter group it is a most useful measure and it is probable that the majority of greenstick fractures of the neck with the usual backward and inward angulation could be reduced by manipulation if treated early. The important thing while carrying out the manipulation is to remember how the fracture was caused and forcibly to perform the opposite movements, viz., adduction and extension, with the thumb pressed firmly on the back of the head of the radius. This maneuver is facilitated in most cases by supination.

Operative treatment. For fractures of the neck with displacement, early manipulation should be carried out and open reduction undertaken only as a last resort. For a completely detached fragment displaced into the joint, removal of the fragment is necessary. For comminuted fractures, total excision of the head should be done; for depressed marginal fractures, either conservative treatment or total excision of the head is advised, but not removal of the depressed fragment only.

Results from conservative treatment. The simpler the injury the greater is the chance for recovery of full range of movement. The contrast between the displacement of marginal type with only 37 per cent recovery of full range of movement and the simple crack with 78 per cent recovery is very striking. Analysis of the cases with limitation of movement greater than 10 degrees shows that extension is the movement most frequently affected. Among 67 cases of all types, limitation of extension occurred in 92 per cent, of flexion in 31 per cent, and of pronation and supination each in 23 per cent. In the simple fractures without displacement extension was usually the only movement affected, while in the complicated fractures and fractures with displacement, movement was commonly limited in several directions. There is a very low percentage of cases with severe symptoms, compared with the relatively high percentage of cases with considerable limitation of movement in the cases treated conservatively and by operation.

Results from operative treatment. The author believes that the earlier the operation is done the better the result. Some of the poorest results were among the comminuted fractures treated by partial excision of the radial head. In such cases there is increased tendency to new bone formation around the head and neck.

The majority of the cases of greenstick fracture of the radial neck were treated conservatively, and it was only those with fairly marked deformity which were manipulated, and again only those which failed to respond to manipulation were subjected to open reduction. Although the greater number of those not manipulated had no appreciable deformity, there were among them 9 cases with definite, though slight, deformity. When these were followed up, every one was found to have a full range of movement. There were also 9 cases with more marked deformity treated by manipulation, and of them 8 were found to have a full range of movement when followed up. These figures contrast strongly with those in which it appears that only 1 of 7 patients who underwent open reduction obtained a full range of movement. In the remaining 6 cases there was a very high degree of limitation, ranging from 15 to 90 degrees, confined in 5 of the 6, to radio-ulnar movement. Of the 6 patients with limited movement, 3 had limitation of pronation only, and 1 of supination only; the fifth had limitation of both pronation and supination, while the remaining patient had limitation in every direction. The last was the only one with roentgenological changes which offered an explanation; the remainder (with the possible exception of 1 not subjected to the roentgen rays) showed practically no roentgenological evidence that a fracture had ever occurred in the neck of the radius. Bohrer has reported a series in children in which proliferative periostitis followed operation in a high percentage of cases. In the present series, this occurred only in the one case in which perfect reposition was not obtained; furthermore this was the only case in which any movement other than rotation was affected. This, therefore, is not the explanation for the limitation of rotation. The author believes that the explanation must be found in the formation of adhesions between the neck and the orbicular ligament divided at operation, and suggests that this might be one of the few conditions of the elbow which could be benefited by manipulation.

In this series removal of the head was never carried out in children, but among adults it was done in 23 patients, and there resulted only 2 cases of definite cubitus valgus amounting to an increase of 20 degrees and 1 case with slight lateral mobility. There were no cases with obvious secondary changes in the wrist, and the only other complication following operation was 1 case of myositis ossificans, following total excision for a comminuted fracture associated with a dislocated elbow.

ROBERT P. MONTGOMERY, M.D.

Eastwood, W. J., and Jefferson, G.: Discussion on Fractures and Dislocation of the Cervical Vertebræ. *Proc. Roy. Soc. Med.*, Lond., 1940, 33: 651.

Clinically the cervical spine can be divided into two different areas, the first two vertebræ and the last five. The specialized function of the axis and atlas deserves separate consideration. There are two types of injury seen in the area of the axis and atlas: (1) injuries of the odontoid process; and (2) dislocations at the atlanto-axial joint. Fracture of the odontoid may occur at its tip but is more common at the base. This lesion is often overlooked unless displacement is present. Hence careful roentgen-ray studies must be made to protect the patient from subsequent locking. Displacement forward of the atlas may accompany the fracture and may cause sudden death. When the displacement is not so severe, the possibility of further displacement later must be kept in mind.

The author recommends recumbency from two to six weeks and then immobilization with a carefully made leather collar which extends well down the front and back of the thorax. Occasionally the atlas will be displaced forward without fracture of the odontoid. This accident is usually fatal, but when not, is treated as described. Rotary dislocations of the atlanto-axial joint are possible, but rare.

Injuries to the lower five vertebræ are either fractures or dislocations, or combinations of both. For simple fractures of the body the usual treatment is hyperextension. A neutral position is used for fractures of the neural arch without displacement. Most authorities favor a Minerva jacket. The author states that he has been impressed with the good results which have many times followed what seemed inadequate treatment and hence is inclined to condemn the Minerva jacket and use a molded collar. In bilateral dislocations the mortality is high. However, in unilateral dislocations serious spinal-cord symptoms are rare. Eastwood is inclined to favor immediate reduction under general anesthesia, while Jefferson is inclined to favor continuous traction especially as he believes that cord injury is most often produced by disc débris on the ventral surface. Continuous traction for some time corrects this. He advises skeletal traction with wire. After reduction, immobilization must be maintained for at least two months.

Fracture-dislocations cause the greatest percentage of cord symptoms and mortality. As a rule, complete dislocation of the articular processes does not occur, and replacement may be secured by hyperextension. If, however, the displacement is complete, traction is essential. Recumbency for three months is necessary. Fortunately a certain amount of deformity causes no pain if there are no nerve root or cord symptoms. Root injuries are the rule whether the cord is involved or not. Pain radiating down the shoulders and arms is often present. Loss of motor power is a less grave sign than loss of sensation. Those patients do best who have primarily only a partial sensory loss with some power of movement.

HAWTHORNE C. WALLACE, M.D.

Bonnin, J. G.: Dislocations and Fracture-Dislocations of the Talus. *Brit. J. Surg.*, 1940, 28: 88.

A rare case of anterolateral fracture-dislocation of the talus is reported. There are 115 cases of fracture-dislocations reported in the literature. The incidence is highest in young adults. In children the leg breaks

before the necessary force to dislocate the talus is developed, and in the aged the calcaneus collapses. Bilateral cases have been recorded twice in the literature. A history of a fall from a height onto the foot is usually given. Forty-four per cent of cases are compound, and in them the talus can often be seen in the wound. When the condition is not compound the skin is very tense over the displaced bone, and the appearance depends upon the position of the fracture; there may be circulatory changes or various stages of gangrene may be noted. Crepitus is usually absent.

The predisposition of the talus to dislocation arises from the facts that it is the only bone in the body without muscular attachment and that three-fifths of its surface is articular. There is a weakness anteriorly and posteriorly corresponding to the plane of greatest freedom of movement, and it is in either of these directions that dislocation without fracture of the malleoli occurs. The talus forms part of three joints, the talocrural, talocalcaneal, and talonavicular. Dislocation is possible at any one joint alone or in combination and to this may be added a variety of fractures so that the number of possible combinations is great. A classification of dislocations and fracture-dislocations of the talus is given and the mechanism of dislocation is discussed.

It is emphasized that there is a generous blood supply to the talus from all the vessels in the region and this is important in considering the chances of viability of the bone following dislocation. It is surprising how great the chance of survival is, even following complete dislocation. The close relationship of the dorsalis pedis artery makes it vulnerable to rupture or pressure in anterior dislocations. The fear of necrosis of the talus is quite ungrounded. In all but 1 of 13 of the 20 recently published cases, in which reduction of the dislocation was done and including 2 cases in which the talus was completely removed, washed in saline, and replaced, the results were satisfactory. In this 1 case reduction was done four days after the accident. These reports serve to emphasize the almost uniformly good results which have occurred after early reduction. Another important point is that when once the case has started to do well, it continues to progress satisfactorily and reports at intervals of years show the talus to be in good condition. It is emphasized that complete separation of the talus from all its attachments does not justify removal of the bone if the case is seen early. The results in cases in which the bone has remained dislocated for more than forty-eight hours before it was reduced are bad, and warrant early removal of the fragment or the whole bone. After forty-eight hours' displacement the bone undergoes degeneration. This is possibly a true avascular necrosis; the bone begins to lose its sharp outline and, later, fragmentation with complete destruction of the joints occurs. With an insufficient number of cases to decide upon, and in the present state of our knowledge, one would be tempted to try the return of the dislocated bone, particularly in the less complete lesions, in all cases under a week's duration of unreduced dislocation. If it became apparent that the bone was degenerating, then recourse would be made to early talectomy, or partial talectomy, if the neck and head of the bone were viable.

The transitory increased bone density in dislocated and replaced tali may be due to some change in the interior of the bone, such as an increase of radio-impermeability due to the breakdown of fats in the cancellous tissue from poor blood-supply. In other words, the avascular necrosis is in the cancellous bone spaces and not in the bone itself.

Reduction by the use of skeletal traction is a definite aid in that it gives a controlled extension of the space between the talus and the calcaneus. An open reduction may be necessary. Further observations are necessary to determine the maximum period of immobilization, but it is suggested that from one month to six weeks should be adequate and it appears advantageous to free the leg for exercises and merely avoid weight-bearing, after three weeks.

The author has presented in detail his case of anterolateral fracture dislocation of the talus which was reduced. Following the reduction there occurred a transitory increased density in the talus and only a minimum of limitation in motions of the ankle and subastragaloid joints remained. There was no subjective complaint or crepitation upon motion. Roentgenograms and diagrams are included.

The reviewer has had the experience of observing an anterior dislocation of the talus in a spastic extremity due to an extreme equinus position. Its existence was not known by the patient or his family. Satisfactory reduction was obtained by dorsiflexion of the foot to a right angle with the leg. There was an accompanying loud snapping sound.

ROBERT P. MONTGOMERY, M.D.

ORTHOPEDICS IN GENERAL

Mitchell, W. R. D.: The End-Results and Treatment of Tuberculous Disease of the Ankle and Tarsus. *Brit. J. Surg.*, 1940, 28: 71.

Tuberculosis of the ankle ranks fourth in the order of frequency with which the larger joints are affected. The author reviewed 169 cases and the progress of the condition in 77 children and 45 adults was followed for a minimum period of three years from cessation of treatment.

Patients under seventeen years of age at the commencement of the disease were classified as children. The reaction of the patient and the course of the disease depended on the age of the patient. In most children, if the disease was efficiently treated in the early stages, a good result with a usable foot could be anticipated, irrespective of tuberculous lesions elsewhere. New tuberculous joint infections often made their appearance even when the primary lesion was in the terminal stages of healing, but the added infection, while it reduced the general condition, fortunately did not seem to have any effect on the ankle joint, which proceeded to heal normally.

Extra-articular disease. The infection here could be situated in the soft tissues as a bursitis, tenosynovitis, superficial abscess, or in the bony structure as a localized bone abscess. The results were good in 18 cases without exception.

Synovial disease. In every instance of 8 cases a generalized decalcification of the foot bones could be seen, combined with marked synovial thickening. No focus of bone erosion was ever detected, and the result in all patients was good.

Intra-articular disease. Ten of the 36 cases showed involvement of the posterior compartment of the subastragaloid joint, and other intra-articular infections involved the astragaloscaphoid and the anterior half of the subastragaloid bone, the anterior tarsus, the tarsus as a whole, and the cuboid bone.

Sinus formation was present in 71 per cent of the patients, but in spite of this, subsequent bony ankylosis occurred in only 2 instances. In the face of results one must conclude that a sound fibrous ankylosis is no disability.

It is often taught that secondary infection of a joint leads to bony ankylosis, and while this may be true in other situations, such is not usually the case in the ankle joint.

Treatment of children with very few exceptions should be conservative and adequate treatment includes one long period of immobilization in recumbency at the outset, usually by means of a right-angled foot-splint, with encircling bands of adhesive strapping over which a firm bandage is applied. With this appliance the skin is kept in good condition and abscesses may be detected in the early stages.

Roentgenographs are taken monthly for three months and then every four months until no further recalcification can be detected. When it is judged that recalcification is complete, a further six months' recumbency is always desired before the limb is put to the test.

No great stress is laid on sunlight and tuberculin therapy has been abandoned.

Although sinuses are regarded as a sign of activity, they are not considered a complication, nor do they seem to retard healing. When an abscess appears it may subside following aspiration, but, fortunately or unfortunately, according to the view held, a sinus usually develops. In pure tuberculous disease the temptation to enlarge a sinus and scrape out material must be resisted, because a shortening of the period of disability never results from this procedure. It should be performed only when a superimposed osteomyelitis with sequestrum formation is present. The sinus is kept covered carefully with sterile gauze until healing takes place. When discharge is profuse the use of medicated sawdust has been found useful as an absorbent and deodorant. Biopsy is not justifiable on account of the danger of sinus formation and the risk of local and distant spread of infection.

There is no similarity between tuberculosis of the ankle in children and in adults except for the ultimate etiological factor. The end-results in the 45 adults followed up are as gloomy as those in the children are encouraging. Only 12 patients were able to resume work with the disease cured, and there is no guarantee that these ankles will remain permanently healed. It is considered that a follow-up over a longer period than has been possible here would show an even smaller percentage of cures. There are no clear-cut forms of involvement in adults.

Adequate conservative treatment is rarely possible in adults because few patients can stand the strain of absolute inactivity even for one year and may for their own reasons not consider such a suggestion.

The disease is insidious and therein lies its danger. It is easy to understand the difficulty of impressing upon the patient, who complains only of a slight ache in the ankle joint, that amputation is necessary. Commonly, if amputation is decided upon, it is delayed until its full benefit cannot be realized. Conservative treatment should be tried only for a limited period, and if the response is not satisfactory, amputation should be performed without further delay. By early amputation, i.e., within twelve months from the commencement of the disease, before gross infection has occurred, the duration of the disease is shortened to a fraction of the time, the chances of a secondary focus are considerably reduced, and the patient is free from the mental strain imposed by a prolonged illness.

Of 23 patients treated conservatively, 8 died with tuberculous disease elsewhere. In other words, approximately 35 per cent died, and all were found to have secondary tuberculous lesions in other parts of the body. Fourteen patients were treated by early amputation within one year of the commencement of the disease. Thirteen of these were found to be living, all with a reasonable expectancy of life. One had died from secondary tuberculous disease.

The author emphasizes that adults with a tuberculous ankle die, not directly from the ankle-joint infection, but from tuberculous lesions in other parts of the body which appear subsequent to the ankle infection, and none of the patients who have had an early amputation, with 1 exception, have developed serious secondary lesions.

He summarizes the benefits to be derived from early amputation as follows: (1) the period of disability is shortened; (2) the primary lesion is removed and secondary infection prevented; (3) worry and mental changes produced in the patient by a long illness are absent; (4) the mortality is lowered; and (5) hospital accommodation and expense are less.

It is the author's strong belief that the less radical operations, such as scraping, excision, astragalectomy, and arthrodesis, have no place, and serve only to prolong the period of disability and endanger life. Too many patients die with tuberculous foci elsewhere, and some of these could probably be saved by early amputation. Detailed explanations for this point of view are offered.

The plan of treatment in patients over forty-five years of age should be amputation performed through the upper tibia without delay. In patients aged from

seventeen to thirty-five there should be six months' trial of conservative treatment by immobilization of the ankle in recumbency in an open-air hospital. If the lesion then shows definite signs of healing, a further period may be prescribed under strict observation all the while. If at any time progress becomes arrested for more than three months, amputation should be performed immediately. In patients aged from thirty-five to forty-five years amputation should be considered if there is any doubt as to the patient's general condition. One should never wait for casts in the urine and other signs of general infection.

ROBERT P. MONTGOMERY, M.D.

Dubois, M.: Amputations of the Lower Extremity (Die Amputationen der unteren Extremitaeten). *Helvet. med. acta*, 1940, 6: 781.

In the supplying of an artificial limb to one who has had a leg amputated we must begin with the study of the amputation itself. Moreover, as unalterable conditions are brought about by the amputation it may be advisable to go backward a little and apply what has been learned from the building of prostheses to the contemplated surgical procedure. The surgical procedure must be carried out with full understanding of the difficulties and limitations encountered in the manufacture of an artificial limb. As the stump has only a very small functional use, the construction of an artificial limb must be considered independently of its possible function. The artificial limb should sustain the body weight and aid in locomotion, but it must simulate the normal limb in appearance. It should be movable without undue effort, but should give sufficient security in standing and walking. In addition, it must permit comfortable sitting. Security in standing and the possibility of locomotion must not without further consideration be combined haphazardly; the solution of the artificial limb problem will probably depend upon the individual preferences of the patient regarding the best compromise between security in standing and good locomotion.

The artificial limb is constructed according to the axis, length, weight-in-water, and angular relationships of the human body. The body is divided into two weight-bearing points. One begins at the center of the hip-joint. This point lies a little to the side and a little in front of the edge of the great trochanter. First the sound limb is measured. The axis drops from the middle of the hip-joint, over the middle of the knee-joint, and through the ankle-joint to the inner edge of the foot. On the side it drops from the anterior edge of the great trochanter, in front of the knee-joint, but behind the ball of the foot.

From the amputated limb stump measurements are taken with weight, line, and rule to determine the different axes of the artificial limb projected into space. The contour of the stump is obtained by cutting out of stiff paper patterns at different levels and these patterns are then employed in the making of the limb. The stump on cross section has a triangular shape. A cast of the stump is not necessary. The orthopedic mechanic employs a special apparatus with measuring scale with which the measurements for the reconstruction of the joints are strictly adhered to. There are also simple aids which permit the physician to control the construction of an artificial limb and the evaluation of it, and which in spite of individual peculiarities of the case enable the physician to see that the fundamentals are adhered to. The axis lines, however, offer only guides for the static function of the artificial limb. It is important to find that position of the limb which is most favorable for locomotion and yet does not interfere with the stability of the leg. For stability the axis line must extend from the central weight-bearing point to in front of the ankle-joint, and the ankle-joint must be weighted against dorsal flexion. The axis of the knee-joint must be behind the line. The stability of the artificial limb increases the farther the axis of the knee-joint is placed posteriorly. By bending the femoral portion of the artificial limb posteriorly one can obtain the same result and at the same time avoid the uncomfortable overstretching of the stump. However, there should be no demands made upon the stump and only a limb constructed according to physiological laws and with consideration of the weight-bearing points will take care of even poor stumps.

In cases of exarticulation of the hip-joint it is necessary to supply a pelvic socket with an artificial hip-joint, which in a position of slight flexion is safeguarded against overextension. In amputations of the thigh the artificial limb has a slightly bent form; however, it must correspond mechanically to the axis relations previously emphasized. It must offer stability in weight-bearing. This is obtained principally by an ankle-joint which is properly braced against dorsal flexion. For stability the joint axes must be so placed and locked that the ankle-joint is behind the vertical axis line and the ball of the foot in front of it. The knee-joint must be braced against overextension. To facilitate walking one can move the knee-axis a little forward. In the frontal plane the vertical line drops from the middle of the hip-joint through the middle of the knee-joint and meets the ankle-joint at the junction of the inner and middle third. The axis of the foot should be turned outward about 10 degrees (from 7 to 12). For practical purposes the axis of the knee-joint should be parallel to that of the foot. In the individual case it will be necessary to determine whether one wishes to favor stability or movement. The reserve power of the stump may be the deciding factor. A good stump is always an asset to the wearer of an artificial limb. It is of extreme importance to train the person who has an amputation to take short steps and to bring the hip weight-bearing point as far forward as possible until it becomes a fixed habit and he eventually does it automatically.

In leg amputations it must be remembered that the stump is never weight-bearing; the entire weight

must rest under the knee (tibial condyle and attachment of the patellar ligament) and on the thigh. The boot for the limb must be made so exact that all pumping is avoided. The knee-joint lies a little anterior and a little above the physiological axis of the knee-joint. The foot is brought a little backward. The vertical line from the knee-joint strikes the floor just behind the ball of the foot. For a Pirogoff stump a jointless rigid structure with a shortened heel part is necessary. The ball portion should be so short that it rests just in front of the line coming from the center of the hip-joint. The foot in pes equinus position must be pushed over laterally so that the frontal axis line falls upon the inner edge of the foot. The best material for an artificial limb is wood. The weight of an artificial limb for a thigh stump should not be more than from 2.5 to 3 kgm. Limbs of the lighter metals weigh less than 2 kgm. The fixation of the prosthesis is best accomplished by two shoulder straps or a bandage. The proper construction of the artificial limb permits even relatively safe walking for a person with a bilateral amputation, and even without a cane.

The chart of Von zur Verth is of value to determine the site of amputation. The indications for operation should not be set lightly when one considers the difficulties in supplying an artificial limb; but if it becomes necessary it should be done early. This is true especially in mass destruction of the soft parts in which a peripheral ischemia or toxemia indicates early interference. The vital indication is most important in determining the site below which one must not go. Regarding the technique, a clean amputation should be done with the simplest method of covering the stump. Complicated methods add nothing. The formation of flaps is desirable and does not hinder the wide open treatment of the wound. The flap should not be too large and club-like stumps are to be avoided.

A life-saving amputation obligates the surgeon to provide the best functional means of locomotion for the retained life; the surgeon's duty does not cease with the amputation but with the procurement of the best artificial limb that the patient can use. As soon as the wound is healed the patient must be encouraged to move about, to move the limb, and to accustom himself to walking erect again. Temporary boots with splints may be used. As the stump will gain its ultimate shape only after wearing the artificial limb or boot for some time, a refitting of the boot of the limb becomes necessary. The so-called immediate prostheses are of no advantage. The patient should be provided with the artificial limb as soon as possible as it will take some time for him to educate himself in its proper use.

(Erlacher). Leo A. Juhnke, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD; TRANSFUSION

Mauro, E.: Thrombopenia in Idiopathic Purpura Hemorrhagica. *Arq. de cirurg. clin. e exper.*, 1940, 4: 63.

A successful splenectomy in 1916 in a case of Werlhoff's disease seemed to prove Kaznelson's hypothesis that the spleen is an important factor in this disease. Four other findings also appeared to support this hypothesis: (1) splenomegaly which suggested hypersplenism; (2) the enormous amounts of phagocyted blood-platelets in removed spleens; (3) the immediate rise of these platelets in the circulating blood after splenectomy; and (4) the hyperfunction of the bone-marrow, in producing these platelets. Later studies have revealed that not one of these data is beyond criticism.

It has been shown that blood-platelets do not play the rôle they were believed to play in normal hemostasis, blood-clotting, and clot-retraction.

Experimental studies were made by the author on rabbits, which animals have a platelet count of marked stability. The effects of repeated injections of fresh spleen extracts were studied. A decrease of the platelet count was detected only when the extract was given in enormous doses. When the extract was given in small doses, such as most probably correspond to the increase as found in human disease, the initial finding was an immediate rise of the blood-platelets.

Most authors believe that the activity of normal spleen on the bone-marrow is a double one, both inhibiting and exciting, and finally "regulating" the production of blood elements. This double activity is probably also to be found in the platelets. In idiopathic thrombopenia there would be great activity and, perhaps, such an abnormality, that the production of a great number of blood-platelets as well as the inhibition, or final exhaustion, of the bone-marrow, would occur and different degrees of thrombopenia would be produced.

On the basis of this double activity of the spleen with regard to the platelets, the author believes that the following scheme of the phases of idiopathic purpura hemorrhagica may be devised:

(a) The initial phase. The increase of platelet production occurs with hyperactivity of the bone-marrow. The removed spleen is full of phagocyted platelets. A sharp increase of these elements occurs after splenectomy, remaining sometimes for a considerable period.

(b) Inhibition of the bone-marrow. There is thrombopenia and an absence of phagocyted platelets in the removed spleen. There is a less sharp increase in platelet count after splenectomy, and a subsequent rapid decrease to normal or subnormal figures. There are slight alterations of the megacaryocytes.

(c) Inhibition. The megacaryocytes show definite lesions. Splenectomy is not followed by an immediate increase of platelets; the increase is slow, the number of platelets often remaining sub-normal (even under the so-called "critical number"), while the patient's recovery may be absolute; sometimes the platelets show a considerable decrease again later on.

(d) Deep lesions of the megacaryocytes. Platelets are absent before and after splenectomy.

HERBERT F. THURSTON, M.D.

Glinskyi, A. N.: The Transfusion of Unheated Blood. *Nov. khir. arkh.*, 1940, 46: 151.

Experimental findings and clinical observations on the transfusion of unheated blood led the author to the following conclusions:

1. The osmotic resistance of erythrocytes in preserved blood is diminished after heating to from 30 to 40 degrees, as compared with a blood specimen preserved at a temperature of from 10 to 12 degrees.
2. The minimal resistance under such circumstances changes more than the maximal resistance.
3. The osmotic resistance of erythrocytes at the temperature of +20 degrees remains the same as at +10 degrees.
4. The number of microcytes in preserved blood is increased markedly after heating to a temperature of from +30 to +40 degrees, as compared with blood kept at a temperature of from +10 to +12°.
5. The author used unheated preserved blood in 214 cases and noticed a clinical reaction in 26.1 per cent of them, as compared with 38 per cent when heated blood was used.
6. The use of unheated blood with a temperature of from +10 to +12 degrees greatly simplifies the technique of blood transfusion, which is of particular importance under war conditions.

JOSEPH K. NARAT, M.D.

Kolmer, J. A., and Howard, M.: Studies on the Preservation of Human Blood. *Am. J. M. Sc.*, 1940, 200: 311.

The authors report studies made to determine the properties of four well known preservatives of human blood. These preservatives were studied not only in relation to the fragility, dehemoglobinization, and disintegration of erythrocytes, but also in relation to the preservation of leucocytes with special reference to the neutrophils and platelets, as well as to the prothrombin time, isoagglutinins, complement, and bactericidal activity.

Using the four different preservatives, the preservation of the blood of 2 adult donors, belonging to Groups A and B, was investigated when kept up to twenty-one days from 4° to 6° C. Two of the preservatives were without carbohydrate, the third with dextrose, and the fourth with dextrin. Exami-

nations were made within twenty-four hours and at the end of three, five, seven, ten, fourteen, and twenty-one days' preservation, for dehemoglobinization, fragility, and preservation of the erythrocytes, preservation of the leucocytes with special reference to the neutrophils, preservation of the platelets and prothrombin, and the preservation of the isoagglutinins, complement, and bactericidal activity.

From this study it is apparent to the authors that none of the four preservatives employed in this investigation affords adequate protection of the neutrophilic leucocytes and platelets. This phase of blood preservation has not received the attention it deserves in relation to the transfusion treatment of the acute and chronic infections as well as in relation to the hemorrhagic states due to prothrombin deficiency. For these reasons the author has advised against the use of blood preserved for more than three days for these therapeutic purposes as fresh blood appears advisable.

Possibly, the same applies to the transfusion treatment of the anemias, although preserved blood appears adequate for the treatment of acute hemorrhage and surgical shock. For these purposes, the authors believe that the addition of dextrose or dextrin to the preservative is advisable, as both of these substances appear to preserve erythrocytes better than plain citrate or the preservative advocated by the Moscow Institute of Hematology.

The two carbohydrate preservatives gave better protection of the erythrocytes against dehemoglobinization, fragility, and disintegration than the plain citrate and Moscow Institute of Hematology preservatives.

Marked reduction of the total leucocytes occurred with all four preservatives within three days, especially because of the disintegration of the neutrophils, but the two carbohydrate preservatives gave somewhat better preservation than the two without carbohydrates. HERBERT F. THURSTON, M.D.

DeGowin, E. L., and Hardin, R. C.: Studies on Preserved Human Blood Reactions from Transfusion. *J. Am. M. Ass.*, 1940, 115: 895.

The authors report the type and frequency of reactions in 2,128 transfusions of preserved blood as compared with the same data on 295 transfusions of fresh blood. Five hundred cubic centimeters of blood preserved by adding 650 c.cm. of 5.4 per cent dextrose in water and 100 c.cm. of 3.2 per cent sodium-citrate solution were found to be more stable than blood preserved with sodium citrate alone. Storage was limited to ten days for the blood-citrate mixture and to thirty days for the blood-dextrose-citrate mixture. The blood was not warmed before administration, which was accomplished with gravity apparatus and through a 20-gauge needle.

Chills and fever occurred in 2 per cent of all the transfusions and were believed to be due to pyrogens contained in the apparatus. There was no relation between the frequency of chills and the duration of storage of the blood or the type of preservative used. Urticaria and hemoglobinuria were noted somewhat less frequently and were also unrelated to the duration of storage.

Two deaths are reported, one due to an incompatible transfusion (Group A to Group O), and the other to circulatory embarrassment. No types of reactions were noted in transfusions of preserved blood which do not also occur in transfusions of fresh blood. THOMAS C. DOUGLASS, M.D.

Crosbie, A., and Scarborough, H.: Studies on Stored Blood; The Leucocytes in Stored Blood. *Edinburgh M. J.*, 1940, 47: 553.

In considering the indications for blood transfusion, in relation to the four main constituents of human blood, the authors note that the first and probably the most important indication is to increase the erythrocyte content of the recipient's blood and so enhance its oxygen-carrying capacity. The second is to increase the circulating blood or fluid volume by transfusing a fluid which approximates, as closely as possible, normal human blood. The third is to increase the "defense mechanisms" of the recipient. The fourth indication is to increase the coagulability of the recipient's plasma. This study is directed toward the behavior of leucocytes in stored blood.

Blood was withdrawn from the majority of the subjects with a closed apparatus. In all cases the anticoagulant was 3.8 per cent sodium citrate, the final concentration of citrate being approximately 0.38 gm. per 100 c.cm. of blood. The blood was stored at from 2° to 5° C. Differential leucocyte counts were all made on cover-slip films stained by Leishman's method. The term "degenerate form" was used to signify a cell which has lost its characteristics.

Neither the determination of the total leucocyte count nor the examination of a stained blood film gave any information regarding the viability of the blood cells. It is, however, upon the maintenance of this property of the leucocytes that the value of transfusion of stored blood in infective conditions ultimately depends. Accordingly, an attempt was made to examine the motility of the leucocytes after varying periods of storage. For this purpose a fresh unstained blood preparation suitably diluted with isotonic saline solution was examined upon a microscope enclosed in a warm chamber, the temperature of which was maintained at approximately 35° C. It was found that at the end of the first twenty-four hours, 11 per cent of the total leucocytes were disintegrated, and at the end of the second twenty-four hours, 28 per cent were disintegrated. From the end of the fourth to the fifth day, 50 per cent were disintegrated, whereas, at the end of the tenth day, 74 per cent of the total leucocytes were destroyed.

When the number of viable polymorphs were calculated, it was evident that blood stored for twenty-four hours will contain about 75 per cent of the number originally present, and that only 5 per cent will be found to remain after five days' storage. This is

obviously a strong argument in favor of the use of fresh blood for transfusion, the object of which is to increase the number of circulating leucocytes. These results do not exclude the possibility that the transfusion of degenerate and non-viable leucocytes may serve to stimulate leucocyte production in the recipient. HERBERT F. THURSTON, M.D.

Mainwaring, B. R. S., Aylward, F. X., and Wilkinson, J. F.: The Potassium and Phosphate Content of Plasma from Stored Blood; Experiments on Amount of Hemolysis, Changes in Potassium, Change in Plasma Inorganic Phosphate, Use of Plasma in Transfusions, and Preservation of Plasma After Separation. *Lancet*, 1940, 239: 385.

The authors studied the hemolysis, potassium diffusion, and phosphate values in blood plasma taken after varying periods (immediately, after two to four days, after fourteen to sixteen days) from blood preserved in sodium-citrate solution, heparin, and sodium-citrate-glucose solution.

The amount of hemolysis in these samples was found to be least when sodium-citrate-glucose solution was used and most when heparin was used, which confirmed previously reported studies by these and other authors.

The diffusion of potassium from the cells was found to be rapid, relatively unaffected by the preservative used, and in agreement with the work of Scudder, DeGowin, and Downman.

The increase in the phosphate level in the plasma was slight compared to that noted in the potassium content; it was greatest in the heparin preserved samples and least in the sodium-citrate-glucose samples.

Since information is not complete on the effect of a high potassium content in infused blood plasma, the authors advise the avoidance of rapid administration of this fluid and early separation from the blood cells as the best means of minimizing this possible danger.

Aside from precipitates in the blood plasma and the milkiness in the plasma samples with a high fat content, no changes were noted in plasma stored over a period of several months.

THOMAS C. DOUGLASS, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Hart, D.: Sterilization of the Air in the Operating Room with Bactericidal Radiation; Results from November 1, 1938 to November 1, 1939, with a Further Report as to Safety of Patients and Personnel. *Arch. Surg.*, 1940, 41: 334.

The author reports the results of wound healing in an extensive series of cases operated upon under a field of ultraviolet radiation. Of 23,216 operations, 2,000 were clean and were performed in a field of bactericidal radiation, and in these no patient died of an operative wound infection. The mortality rate, in this series, was less than 1 per cent and the infections reported were mild and in many instances questionable. Also, it has been shown that a marked reduction in the average duration and degree of elevation of the postoperative temperature reaction occurs.

As regards safety of the patient, the author states that he has never seen any ill effects or had any complaint from the patient referable to the radiation. Criticisms of the intensity of radiation used which have been made by others have been based upon the erroneous assumption that the author used 56.43 microwatts per sq. cm. on the wound, whereas actually it has been only from 28 to 30 microwatts. At the present time all units in use but one, give an intensity of 25 microwatts per sq. cm. at the operative site.

The operating room personnel can be adequately protected by covering or shading. In addition to the usual cap and mask, glasses and a sun helmet should be worn. The eyes must be protected by glasses and a close-fitting eyeshade or hat. It is emphasized that every one using ultraviolet radiation should avoid unnecessary exposure, at least until the risk of often-repeated exposures over a long period is known.

JOHN A. GIUS, M.D.

Smith, P.: Early Rising after Abdominal and Pelvic Operations (Le lever précoce en chirurgie abdominopelvienne). *L'Union médicale du Canada*, 1940, 69: 921.

Smith reports that since 1933, in 900 surgical cases in which abdominal or pelvic operations were done, he has had patients get out of bed within a few days after operation; this represents approximately 85 per cent of the operations of this type done in this period. In this series of 900 cases there were 4 postoperative deaths, and these could not be attributed entirely to the patients' getting up soon after operation. These deaths included only 1 case of embolus. In no case was there any serious breaking down of the operative wound; a number of patients got out of bed and walked about with a small drain in the wound. In 215 hernias operated upon in this series, there were only 3 recurrences. A considerable number of the patients have been re-examined from six months to a year following operation, and in all the operative scar was in good condition.

The time at which the patient is allowed to get up varies in different cases, but in all these cases it was within the first five days, often within the first twenty-four or thirty hours. When the patient first gets up, he is allowed to sit on the edge of the bed for a time, and as soon as the circulatory equilibrium is established, he may either be seated in a chair with the aid of the nurse, or take a few steps. The distance that he may walk is increased day by day. Patients may be somewhat apprehensive on first getting up, but they soon learn that it does them no harm, and enjoy it. In most abdominal and pelvic operations with modern aseptic precautions, if the patient is not in a state of shock, early rising is indicated. However, it is not advisable in patients with cardiac disease, diabetes, anemia, or disease of the liver or kidney. Special care must be exercised with obese and elderly patients.

The method of early rising is possible only with modern surgical technique—the strictest asepsis, careful suture, for which the author favors buried sutures, and the use of the newer, least toxic anesthetics. Recently the author has operated under infra-red and ultraviolet light, which he considers of definite advantage in reducing postoperative illness.

Getting the patient out of bed within a few days after operation has many definite advantages. It stimulates intestinal peristalsis which relieves "gas pains" and abdominal distention; it also stimulates bladder function and relieves urinary retention; the postoperative use of narcotics is much reduced. Most important of all, it maintains the circulation of the blood and lymph and prevents circulatory stasis, and is thus one of the best prophylactic measures against postoperative thrombosis and embolism. In the author's experience, as well as in the experience of other surgeons using this method, the incidence of these complications has been definitely reduced. The period of convalescence and the stay in the hospital is shortened in some cases by 50 per cent, as compared with the usual period of hospitalization in operations of the same type. This is of definite advantage not only to the patient but also to the hospital.

ALICE M. MEYERS.

Meakins, J. C.: Shock—Its Cause and Treatment. *Canadian M. Ass. J.*, 1940, 43: 201.

Shock presenting a singular clinical picture may follow dissimilar pathological states. It has been designated surgical, traumatic, postoperative, and posthemorrhagic, but it may occur in severe infections, burns, severe anemias, pancreatitis, peritonitis, acute coronary and pulmonary artery lesions,

high intestinal obstruction, severe diarrheas, and other conditions. An increased permeability of the capillaries occurs, as well as a diffusion of plasma fluids into surrounding tissues. The fixed cells undergo alterations and the intracellular and extracellular equilibrium of the electrolytes as well as of the fluids is deranged. It is these changes that result in the circulatory disturbance characterized later by a drop in the blood pressure.

Variations in the severity of the symptoms depend on the individual and the degree of the insult responsible for the initiation of shock. The beginning and progression of "shock" is best detected by frequent and accurate estimations of the hemoglobin or with the hematocrit. A rising hemoglobin percentage or an increase of cells to the plasma ratio indicates hemoconcentration due to loss of plasma through the capillary walls. This is probably the earliest indication of shock. Hemorrhage blurs the picture but does not obliterate it. A fall in the blood pressure is a relatively late indication and should not be awaited to institute treatment. Saline infusions are of value in preventing shock because they dilute the toxins and promote diuresis to eliminate the toxins and products of tissue maceration. Blood transfusions in addition supply hemoglobin and blood proteins. After shock has developed, saline infusions are not of much value but blood transfusions are indicated in hemorrhage. The correction of abnormal capillary and cellular permeability and the effects of this permeability are indicated. Concentrated serum infusions help to restore the osmotic equilibrium of the blood which has been reduced through loss of colloids into the extravascular spaces. Potent adrenocortical extract specifically strikes at the root of the condition by correcting the abnormal capillary and cellular permeability.

MANUEL E. LICHTENSTEIN, M.D.

Best, C. H. and Solandt, D. Y.: Studies in Experimental Shock. *Canadian M. Ass., J.*, 1940, 43: 206.

The present work was undertaken with a view to evaluating certain methods of treating shock in experimental animals. Shock was produced by the use of histamine, hemorrhage, trauma, and a combination of trauma and hemorrhage. There was produced a decrease in the volume of circulating blood which resulted in a low blood pressure. Marked capillary atony resulted in ischemia of the arteriolar and capillary walls. This maintained the atony after the original cause had been removed. It appeared that there is a factor in the production of wound shock which acts on tissues which have not been directly affected by the mechanical injury. The loss of fluid at the site of injury is also an important factor in wound shock.

The methods of treatment must be aimed at halting the various etiological processes and correcting their results. Infusion of concentrated blood serum or plasma restores the blood volume and helps to withdraw fluids from the tissues into the vascular system. Plasma and serum prepared in such a way as to be non-toxic are therapeutically identical and may be kept indefinitely without deterioration. The experimental results indicate that unless the blood pressure is very low, pituitrin rather than epinephrine is the better vasoconstrictor to use preceding the administration of concentrated serum. Usually the serum was given when the pressure was arising under the influence of the vasoconstrictor. In this way it was thought that leakage of the serum through the walls of the dilated blood vessels might be minimized. The fact that this procedure in many cases yielded a relatively prolonged rise in blood pressure such as was never seen under comparable conditions after the administration of either the concentrated serum or the vasoconstrictor alone lends support to this view.

It is questionable if one can obtain permanent recovery of the animals in which the blood pressure has sunk so low as to require the use of a vasoconstrictor. The results of all experimental work on shock are difficult to evaluate because no two animals react in exactly the same manner to either the shock producing procedure or the treatment. Shocked animals respond similarly when the condition is initiated by any one of the experimental methods employed. In traumatic shock the injection of a hypertonic fluid is more beneficial than an isotonic one of the same constituents.

The value of concentrated serum has been tested in human cases. Concentrated human serum was obtained by the Thalhimer technique. Human plasma was concentrated by the lyophile technique. Type O concentrated serum can be given safely to any recipient. Further studies are being conducted with the other types.

MANUEL E. LICHTENSTEIN, M.D.

Elman, R.: Parenteral Replacement of Protein with the Amino-Acids of Hydrolyzed Casein. *Ann. Surg.*, 1940, 112: 594.

The author's observations are concerned with the injection of an enzymatic hydrolysate of casein containing all amino-acids present in casein, including tryptophan, capable of maintaining nitrogen balance, and promoting normal growth in rats. The preparation has the power of provoking restoration of the serum albumin in experimentally produced acute hypoproteinemia.

The dry powder was made up as a 10 per cent solution which was heated to 90° C. and passed through a Seitz (EK) filter; amounts of 100 c.cm. were poured into flasks containing 400 c.cm. of sterile 10 per cent glucose and adequate electrolyte was added. The mixture was then injected intravenously during one hour. A maximum of 400 c.cm. daily, containing 9.6 gm. of nitrogen and 1,600 calories, was injected intravenously in 35 human adults, as the sole source of alimentation, with the particular purpose of parenteral protein replacement. The period of treatment varied from one to twenty-three days and averaged over ten days.

Reports are given of 8 representative cases of which 2 were normal controls, 2 pre-operative, and 4 postoperative patients. Evidence of utilization was shown by the achievement of nitrogen balance, increases in the serum-protein concentration, and clinical improvement, particularly after serious operations. After serious operations many patients excreted large amounts of urinary nitrogen, indicative of "toxic destruction of protein." Clinical improvement during treatment seemed to be associated with the partial or complete replacement of this nitrogen loss by the amino-acids administered.

Various difficulties, among which occasional reactions have been the most serious, are described and discussed. They are being rapidly solved by newer methods of preparation of the amino-acid mixture and of the solutions made from it.

WALTER H. NADLER, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Speirs, R. E.: Immediate Repair of Flexor Tendons. *J. Kansas M. Soc.*, 1940, 41: 370.

To obtain the best results after injuries to the hand, there are certain fundamental principles which should be followed. Knowledge of the anatomy and function of the individual nerves and tendons of the hand and forearm is the first consideration, since only with this is it possible to make an accurate determination of the damage done and the surgical procedures which will be required.

When the patient is first seen, a sterile dressing should be applied to the injury; bleeding is best controlled by the use of a tourniquet. The extent of the injury is next determined by observation of function of the hand, and not by probing or exploration. An excellent review of the anatomy and loss of function resulting from division of various tendons is given.

The treatment to be administered is determined by the time which has elapsed since the injury occurred, account being taken of the character of the first aid that has been given. Tendons of the fingers and hand should not be repaired after six hours, and those of the wrist not after eight hours.

In the operating room a blood-pressure cuff inflated to a pressure of 250 mm. of mercury is the most satisfactory tourniquet. In the preparation for surgery the dressing, with exception of that portion covering the wound, is removed. The surrounding skin is carefully washed with soap and water, and the wound is then gently irrigated with normal saline solution.

A general anesthetic is considered the most satisfactory; there is a possibility of further damage to already injured tissue by local infiltration.

The smallest instruments available should be used. The best grade of No. 0 or No. 1 silk suture material is most satisfactory, and the technique emphasized by Halsted should be followed. The type of stitch for suturing tendons is discussed. The author advises a simple suture (based on experimental work) which simply catches a bite of tendon on each side and traverses the tendon. This suture may either follow within the tendon or along the sides.

Most lacerations of the fingers and hands run transversely, and since it is not possible to find the tendon ends through such a wound, enlargement is necessary. Mid-lateral incisions are best in the fingers, but they should not be long enough to destroy the pulleys. Often it is better to make a second separate incision than to keep extending the primary laceration. The incisions should follow the lines of the normal flexion creases, for a cut down the middle of either the finger, hand, or wrist tends to form flexion contractures. Often, by means of these secondary incisions, the tendon can be lifted out and a mattress suture can be made in it. These sutures may then be threaded through the tendon sheath and canal with a probe, and the tendon pulled through.

The author explains in detail the anatomy and value of the fibrous aponeurosis within the fingers. When the tendon is divided within this fibrous sheath, it is necessary to enlarge this laceration of the aponeurosis and leave a small defect, provided this defect will not be extensive enough to destroy the pulley action.

The tendon ends can sometimes be found more easily by flexing the elbow, wrist, and fingers; milking the forearm is seldom successful. The least harmful way to find the ends is to enlarge the incision. After the tendon ends are found, they should be treated with great care. The sutures should be placed immediately so that further manipulation can be made by the use of the suture. After repair of the tendons, the wound is gently sponged in order that the operator may see that all bleeding is controlled; this should be absolute. Digital nerves should be approximated as well as possible. The interosseous and lumbrical muscles should be sutured, and the skin edges closed.

Immobilization should be continued for three weeks. A splint or plaster is used for flexor tendons, and this should fix the elbow at right angle, the wrist at 75 degrees, and the fingers in slight flexion. Physiotherapy is started after three weeks of immobilization.

In general it may be said that good results will be obtained in 95 per cent of extensor-tendon injuries, in 90 per cent of flexor-pollicis-longus injuries, in 85 per cent of injuries of the flexors of the wrist, and in 65 per cent of injuries of the flexors of the palm and fingers.

HARVEY S. ALLEN, M.D.

Cohen, S. M., and Schulenburg, C. A. R.: The Treatment of War Wounds of the Limbs; Experience in 266 Cases. *Lancet*, 1940, 239: 351.

The "plaster method" of wound treatment is described and evaluated by the authors, who have had a particularly advantageous opportunity to study 266 cases of severe war wounds. Of the 84 cases

treated with "plaster," 54 were compound fractures, the remainder being extensive soft-tissue injuries.

Briefly, the wounds were routinely subjected to careful skin preparation: all obviously tattered skin and fascia muscle were excised, loose-lying bone fragments were removed, and bleeding points were crushed. Radiating incisions were made into the skin for better exposure and into the fascia for relief of pressure. Foreign bodies, if readily accessible, were removed, otherwise left unmolested. Drainage was provided by dependent counter incision. No wound antisepsis was used and in the case of large defects, the wounds were left wide open and packed with petroleum jelly gauze. All fractures were set up in the skin-tight plaster except for the use of plaster wool which was placed directly over the wound to absorb serum, and wool padding which was placed over points of pressure. The rule always to immobilize the proximal joints on both sides of the wound was followed. The only traction employed, with but a single exception, was manual; it was used until the plaster set.

The authors stress the point that no cast windows should be used as they create wound edema and serve no useful function. Wound infection is detectable easily from the constitutional reaction as well as the occurrence of pain. No anaerobic infection occurred, even in the presence of the gas bacillus which was cultured from 4 cases. Interestingly enough, no anti-gas serum was administered to any patient and yet no infections developed.

The extensive soft-tissue injuries were treated in similar fashion with excellent results. Even the more minor injuries were partially immobilized with elastoplast, and in cases of lower-limb involvement, the patient was confined to bed.

Every patient received routine chemotherapy, a total dosage of 19.5 gm. of sulfanilamide in forty-eight hours.

The described therapy contributed to the excellent results; there were no deaths, only 1 leg amputation for traumatic severance of the popliteal artery, and practically all of the patients enjoyed a smooth convalescence within ten weeks.

STANLEY ROBBINS, M.D.

Brown, J. J. M., Dennison, W. M., Ross, J. A., and Divine, D.: Experience at a Casualty Clearing Station; Operative Procedure; Wounds of the Chest and Abdomen; Wounds of the Head and Eyes; Burns; Anesthesia. *Lancet*, 1940, 239: 443.

A group of 4 military surgeons assigned to a casualty clearing station report their experiences in the treatment of 500 soldiers wounded in the Battle of Flanders. All of the patients were evacuated under fire and suffered, in addition, the hardship of immersion and exposure to the sea. The injured were coated with grime and sand, exhausted by lack of food, and shaken by many hours of continual bombardment.

All the wounded required treatment for shock. When not contraindicated, the patients were benefited by large quantities of hot sweet tea. Blood available from a previously established bank for just such an emergency was of inestimable value. Morphine, fluids, and hastily improvised shock cradles were freely used. Tourniquets, consisting of a variety of objects, such as helmet straps and puttees, saved many lives although the limb distal to the application site was devitalized.

Immediately on arrival at the casualty station, the wounded were graded in the order of necessity for immediate or delayed operation. Those marked for immediate operation suffered from burns, sucking chest wounds, and head and abdominal injuries.

Also selected for immediate operation were those who showed signs of gas gangrene. In cases of massive gas gangrene of a limb, amputation was performed. Areas of local gas gangrene were treated by incision, hydrogen-peroxide irrigation, and packing with sulfapyridine powder. Anti-gas gangrene serum was given intramuscularly and sulfapyridine orally.

The treatment of compound fractures of the extremities and joints consisted of débridement, reduction in "position for regaining optimum function," packing with proflavine soaked gauze, and immobilization in plaster. The wound and the cast were undisturbed for several weeks. The follow-up of patients treated in this manner showed satisfactory results in the majority of cases.

The authors confirmed observations made in World War I: namely, that high-velocity bullets were relatively sterile; bomb fragments and shell splinters caused severe infections; and small surface wounds often hid considerable damage in the subcutaneous tissues.

Short bullet tracks were completely excised. Extensive bullet tracks were thoroughly cleaned at the point of exit and entrance, and incised and drained down to the center of the track. Foreign bodies were removed only in cases in which they caused severe pain or pressure symptoms, and prolonged infection.

Amputation of the upper extremity was always avoided. Injuries of the hand were treated in the most conservative manner.

Fractures of the femur were treated by fixed extension in a Thomas splint and Spanish windlass fixation. The Whitman plaster cast was never applied. Skeletal traction was not used. The anklet method of counter extension with the Thomas splint was found to be more satisfactory than the clove hitch which often caused pressure necrosis. Amputation of the lower extremity was often necessary. The short-flap method of amputation, with a marked limitation in the use of suture material, was preferred to the guillotine amputation. Gunshot wounds of the spine were treated by immobilization in a simple dorsal plaster shell because a spinal plaster jacket was a time-consuming procedure.

Patients admitted with abdominal wounds were treated by early exploratory operation. Pelvic and buttock injuries often inhibited signs of peritonism but by thorough exploration of the wound track, operation was avoided.

Indications for immediate chest surgery were wounds such as compound fractures of the ribs, sucking chest wounds, foreign bodies interfering with respiration, thoraco-abdominal wounds, and massive hemothorax with clot formation or infection.

Most of the head injuries received no operative treatment because of the delay before arrival at the clearing station. They were transferred to a neurological center.

Penetrating injuries of the eye were usually so extensive that enucleation was necessary. Corneal foreign bodies were removed if they were superficial. Deeply placed foreign bodies were not removed, as a rule, because no magnet was available. Conjunctivitis caused by the explosion of bombs responded best to saline irrigations. Burns involving the eyelids responded better to irrigation with saline solution than to coagulation.

All burn cases were of the severest types with more than one-half of the body surface involved and often complicated by gunshot wounds. These casualties were in severe shock on admission. They were treated with morphine and heat and received synthetic corticosterone (10 mgm. every four hours). All varieties of fluids were given by every available route. After shock treatment, anesthesia was given with gas oxygen, and the burned areas were cleansed and treated with 1 per cent gentian violet followed by 10 per cent tannic acid and 10 per cent silver nitrate. Coagulum was encouraged by the reapplication of 1 per cent gentian violet every four hours.

Patients in shock from trauma or hemorrhage rapidly reached the fourth plane of anesthesia after about four whiffs of pure nitrous oxide. Anesthesia could thereafter be maintained with a high concentration of oxygen. In wounds of the oropharynx, preliminary tracheotomy and administration of anesthesia through the tracheotomy tube were recommended. In wounds of the chest, anesthesia was given by means of Magill's intratracheal tube passed by the indirect method.

BENJAMIN G. P. SHAFIROFF, M.D.

Coller, F. A., and Valk, W. L.: The Delayed Closure of Contaminated Wounds. *Ann. Surg.*, 1940, 112: 256.

The authors have employed a method of delayed primary closure of grossly contaminated wounds in 21 patients with no apparent infection in 20 cases, and with only a very minor infection in the remaining case. This group of cases consisted of operations upon the lower bowel, with gross contamination.

The method described is as follows:

The peritoneum is closed with double No. 000 plain catgut, and the fascia is closed with interrupted sutures of No. 30 stainless steel wire. Near-far, figure-of-eight sutures of fine silk are placed through the skin, and a flavine pack is placed under the untied sutures. The pack is removed at the end of twenty-four hours, and the sutures are tied.

When the pack is removed, the wounds appear dry and sticky. Microscopic sections of the wound edges, at twenty-four hours, show an exudate which consists of fibrin, in the meshes of which are polymorphonuclear leucocytes, wandering cells, some necrotic tissue, and many young fibroblasts. It is suggested that after coagulation of fibrin occurs, the resistance of the wound is greatly increased because of the accompanying sealing-off of the capillary and lymph spaces. Delayed closure of contaminated wounds carries the wound through this critical period. Cultures taken from wounds are positive at the end of the twenty-four-hour period, so that packing the wounds apparently has no bactericidal effect. The peritoneum and fascia are undoubtedly contaminated likewise, but apparently these tissues have a higher degree of resistance to infection than the subcutaneous tissues. Infection in wounds of the abdominal wall frequently begins in the subcutaneous tissues and spreads to deeper layers from this plane.

An analysis from records of previous similar types of operations showed that about 50 per cent of the cases showed serious wound infections. Delayed closure as described is believed to be helpful in the prevention of such infections.

LUTHER H. WOLFF, M.D.

Elkin, D. C.: Wound Infection. *Ann. Surg.*, 1940, 112: 280.

A five-year record of wound healing, from 1935 to 1939, was made at the Emory University Division of the Grady Hospital. Wounds were classified as clean, potentially infected, and infected. A careful record of suture materials was kept. Material from wounds which showed serous exudates and hematomas was cultured, and if organisms were recovered the wounds were classified as infected. The records were kept by residents, who presumably had a more impartial attitude toward wounds than the surgeons themselves. With silk, infections occurred in 2.1 per cent of the cases, as compared to 9.4 per cent of the cases in which catgut was employed. In only one year did the incidence of infection with the use of silk approximate the incidence of infection occurring with the use of catgut; the author attributes this approximation to the high percentage of infections occurring in the patients of one particular operator.

The objection frequently raised to the use of silk is that this suture material may act as a nidus of infection. The author believes that this danger has been greatly overestimated. Occasionally a draining sinus will continue until the silk is extruded or removed, but more often healing occurs without removal of the sutures. In the five years tabulated, there were only 2 instances of prolonged drainage, and both healed within six weeks.

With these data evident, there was a more pronounced tendency toward the use of silk in potentially infected wounds. These wounds included compound fractures, wounds of the heart and chest, and gangrenous appendicitis. In comparing the results obtained with the results in similar wounds in which catgut was used, it was found that only 7.9

per cent of the wounds sutured with silk as against 21.4 per cent of the wounds which had been sutured with catgut became infected.

LUTHER H. WOLFF, M.D.

Karnitschnigg, H. von: A Contribution on Serum Prophylaxis in Tetanus (Ein Beitrag zur Serumprophylaxe beim Tetanus). *Wien. klin. Wchnschr.*, 1940, 1: 403.

Huebner opposed the prophylaxis of tetanus. His arguments have already been contradicted by others. The author reports the results obtained during the last twelve years in the Emergency Station No. 1 of Vienna. There were 34,314 traumatic patients altogether, of whom 16,269 were given prophylactic injections. No tetanus developed in any of them. On the other hand, during this time, 29 patients were treated without injections, of whom 12 died. Only 1 of these cases belonged to the author's clinic. This patient did not receive an injection as there was only a thumb contusion with a subungual hematoma, without an open wound. It is difficult to understand how the infection occurred in this instance.

The author states emphatically that tetanus cannot be avoided by a total excision of the wound. In 1 case this was done, and in spite of the surgery tetanus occurred. In 9 other cases excision of the wound was impossible because of injuries of the large blood vessels and larger areas of excoriations. Considering this definite proof of the value of prophylactic inoculations, serum exanthems, even anaphylactic shocks, cannot be regarded as weighty contraindications to this therapy. In the author's clinic there was only 1 such result, and it was a very unique case.

A thirteen-year-old girl received a very small injection of tetanus serum (250 AIE) for a small lacerated contusion of the knee. After a very short time she was in heavy shock with cyanosis, trismus of the masseter muscles, severe dyspnea, cessation of the pulse, and involuntary defecation and urination. She received 5 c.cm. of coramine intravenously, and improvement followed in ten minutes. The next day she was normal. This patient had received 4,000 units of horse-serum five years previously for diphtheria. Experiments were then undertaken in the clinic to establish whether or not a difference existed between the serum exanthemas of the Viennese and of the Behring serums.

There were 154 injections of the Viennese serum made in men; of these, 15 (12 per cent) exhibited exanthematous reactions. There were 74 women who were injected with the Behring serum; only 1 of these had an exanthematous reaction. Of 13 patients with open fractures and gun-shot injuries who received both tetanus antitoxin and gas-bacillus serum, 6 (50 per cent) were afflicted with exanthema. The albumin content of the different sera was also estimated. The Viennese serum contained 1,051 mgm. per cent total albumin, the Behring serum only 607 mgm. per cent, and the gas-bacillus serum 1,121 mgm. per cent. The albumin content of the serum, consequently, is partly responsible for the frequency of exanthemas.

(FRANZ). MATHIAS J. SEIFERT, M.D.

Key, J. A., Frankel, C. J., and Burford, T. H.: The Local Use of Sulfanilamide in Various Tissues. *J. Bone & Joint Surg.*, 1940, 22: 952.

The authors advocate the local implantation of sterilized sulfanilamide not only in contaminated wounds but also in clinically clean operative wounds where infection is especially feared or undesirable. They have placed sulfanilamide routinely in hip-joints opened for arthroplasties and in other wounds without untoward effect, but have not used the drug in clean knee-joints after operations on semilunar cartilages. Saturated solutions of sulfanilamide and 5 per cent solutions of neoprontosil have been injected into infected knee-joints.

Joints and other tissues investigated tolerated the drug very well. The primary healing of clean operative wounds was only slightly inhibited by the powder. In open infected wounds it may be used repeatedly and does not seriously interfere with their healing. Culture media containing an excess of sulfanilamide and inoculated with various concentrations of streptococci, staphylococci, and Welch's bacilli inhibited bacterial growth during the first forty-eight hours but only the streptococci were killed. To sterilize the drug, autoclaving the dry powder in a flask proved satisfactory for clinical purposes; growth of the few surviving bacteria was inhibited and the clearing mechanism of the patient took care of them without difficulty. If lumpy after sterilization the powder was crushed and spread thinly over the surface of the wound after hemostasis had been effected and just before the wound was sutured. When the wound was to be left open or partly open larger amounts of the powder were used.

The effect of sulfanilamide on healing was studied in experimental fractures in rabbits and in operative wounds in muscles, subcutaneous tissues, fasciæ, and the joints of 12 dogs.

WALTER H. NADLER, M.D.

ANESTHESIA

Christiansen, G. W.: A Technique for General Anesthesia in Surgery of the Mouth. *J. Am. Dent. Ass.*, 1940, 27: 1575.

Modern surgical technique has been possible only because of anesthesia, and it is evident that improvements in surgery and in anesthesia have developed concurrently. The author recalls the unsatisfactory methods of nitrous-oxide anesthesia for mouth operations in days gone by and compares them with present-day methods. He calls attention to the safety record of nitrous oxide in dental operations for ambulant patients.

For operations in the dental office preliminary examination and a later appointment for operation, with suitable premedication, is recommended.

The technique of administration of nitrous oxide is discussed, attention being called to the dangers of obstructed breathing, cyanosis, and anoxemia. The symptoms of various stages of anesthesia are described. The author concludes by saying, "Just as examination and diagnosis precede intelligent therapeutic endeavor, they dictate the course of anesthesia. Nitrous oxide-oxygen anesthesia can be adapted to the patient's eccentricities, however varied, provided pre-operative investigation has been painstaking enough to reveal them."

CHARLES W. FREEMAN, D.D.S.

Bass, S.: A Study of Anesthesia in Thoracic Surgery. *Anes. & Anal.*, 1940, 19: 233.

Anesthesia for thoracic surgery presents many problems not encountered in any other branch of surgery. The anesthetist must be on guard to deal with emergencies.

This report concerns the results obtained with various anesthetic agents used in 1,938 thoracic operations, the majority of which were performed on patients with pulmonary tuberculosis. These anesthesias were administered at Sea View Hospital, Staten Island, between 1932 and 1939. Of these 1,938 anesthesias, 212 were nitrous-oxide-oxygen; 225 were avertin; 800 were evipal; 600 were cyclopropane; and 100 were local and regional.

In using nitrous oxide it is still necessary to give high concentrations of the gas to produce the required relaxation. Because of this, sufficient oxygen is not available to the tissues and cyanosis is a prominent feature in 60 per cent of the cases. Other disadvantages are struggling during the induction period, marked increase in the pulse rate and deep, forceful respirations, which are a handicap to the surgeon operating. The advantages of nitrous oxide are that it is non-inflammable and non-irritating and recovery from the anesthetic is rapid.

Avertin (tribromethanol) is given in doses of from 60 to 80 mgm. per kilogram. It is easily administered and pleasant to the patient's taste, and the induction is smooth. Other advantages are the quiet respiration and the small percentage of postoperative vomiting. However, the disadvantages outweigh the advantages. There is a marked fall in the blood pressure, the breathing becomes very shallow, and cyanosis follows in a large percentage of patients. Postoperative depression is prolonged with shallow respiration, cyanosis, and depression of the cough reflex. This favors stagnation of bronchial secretion with consequent increase in pulmonary complications such as atelectasis, pneumonia, and spread of disease to the healthy portions of the lungs. For this reason I believe that the use of avertin is contraindicated in patients with pulmonary disease.

Evipal carries an individual susceptibility which is so variable that in some cases no supplement for anesthesia is needed while in others it is necessary to give additional doses of evipal or supplement this with gas. Anesthesia is produced by giving 1 gm. of evipal dissolved in 10 c.cm. of water intravenously at the maximal rate of 10 seconds per c.cm. In from twenty to forty seconds the patient falls into a natural sleep. Injection is continued at the same rate until twice the hypnotic dose has been given. The patient is watched carefully for signs of respiratory embarrassment. Should this occur, injections are stopped immediately and resuscitative measures are instituted. In 12 of a series of 800 cases apnea occurred. There is an increase in the pulse rate and an average drop in the systolic pressure of 35 mm. of mercury in some patients. Fewer patients were in shock postoperatively than with any other anesthetic agent used. Similarly, fewer postoperative pulmonary complications occur. Evipal is contraindicated in patients with liver damage as well as in patients with long-standing toxemia or septicemia or amyloid disease.

Local and regional anesthesia is indicated in patients that are considered poor risks for general anesthesia. It is also used in those instances in which intratracheal intubation is indicated but in which it is inadvisable. This is true in patients with extensive tuberculous laryngitis in whom there is danger of trauma to the larynx from the introduction of the catheter. With this anesthetic, pain was complained of during the operation in 31 patients and in 8 of these it was necessary to supplement the anesthesia with inhalation anesthesia. Cyanosis during operation was present in 13 cases so that oxygen or carbon-dioxide oxygen had to be administered. Five patients complained of nausea, 5 others vomited, and 3 had arrhythmia.

Cyclopropane is administered by the closed carbon dioxide technique. A slow induction with the soda-lime filter is used. The bag is filled with oxygen and the patient takes several breaths while the mask is being adjusted. Cyclopropane is then introduced at the rate of from 300 to 400 c.cm. per minute and the oxygen flow reduced to 400 c.cm. per minute, and within four to six minutes the patient is anesthetized. The cyclopropane is entirely shut off and the anesthesia is maintained with a constant flow of oxygen approximating as closely as possible the metabolic needs of the patient. If anesthesia becomes too light cyclopropane is added as needed. Cyclopropane is a satisfactory anesthetic for chest surgery. Induction is rapid and smooth. There is only slight excitement in a small percentage of cases. The quiet, shallow respiration during the anesthesia is a great advantage to the surgeon. A sudden increase of the pulse rate is a danger sign. Arrhythmia was noted in 11.5 per cent of the cases. This lasted from a few seconds to ten minutes. A rise in blood pressure occurs during anesthesia in many instances. The advantage of cyclopropane is the rapid awakening following removal of the mask.

Mortality was lowest with evipal and cyclopropane (6.6 per cent and 6.7 per cent). Following local and regional anesthesia the mortality was higher (9 per cent). This can be readily understood when we realize that those patients who receive

local and regional anesthesia were the poorest post-operative risks. The best results have been obtained with cyclopropane and evipal. In the opinion of this writer, cyclopropane is to be preferred of the two. J. DANIEL WILLEMS, M.D.

Silvers, H. I., and Leonard, I. E., Jr.: The Use of Neosynephrin Hydrochloride in Maintaining Blood Pressure During Spinal Anesthesia. *Am. J. Surg.*, 1940, 50: 79.

This article gives the results in 50 cases of abdominal and perineal surgery, with a list of the operations in one table and four chart figures. Quotations are included from a number of articles in the literature on the subject.

The pre-operative medication is stated as well as the amount of neosynephrin and spinal anesthesia used. In each case the blood pressure was maintained and usually the pulse became slower.

The conclusions are that neosynephrin hydrochloride is an effective aid in maintaining the stability of the blood pressure during spinal anesthesia. A definite bradycardia generally occurs after its administration. Deleterious effects such as arrhythmia, palpitation, anxiety, or nervousness were not manifest if neosynephrin was given in therapeutic doses. The margin of safety of neosynephrin is greater than that of epinephrine or ephedrine. It is not effective in cases in which there is a loss of blood volume or shock caused by toxic conditions such as peritonitis. Until its exact action on the heart has been proved it is best to use small doses or abandon its use entirely in cases which present serious cardiac pathology. CARL R. STEINKE, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Sussman, M. L.: The Roentgen Aspects of Non-Putrid Pulmonary Suppuration. *Am. J. Roentgenol.*, 1940, 44: 345.

Non-putrid pulmonary suppuration is a severe form of bronchopneumonia in which necrosis of the pulmonary tissue takes place. The condition is given consideration under the following headings: (1) suppurative bronchopneumonia without abscess; (2) abscess formation; (3) multiple areas of pneumonitis with cavitation; (4) segmental abscess; (5) pulmonary abscess with presenting pleural complications; and (6) bronchial disease. Several cases are cited in detail and illustrated by roentgenograms as examples of some of the conditions described.

ADOLPH HARTUNG, M.D.

Olds, J. W., and Kirklin, B. R.: Primary Carcinoma of the Lung; A Roentgenological Study of 206 Proved Cases. *Am. J. Roentgenol.*, 1940, 44: 357.

The present study was undertaken to find out what may be learned from a review of the roentgenograms in a large series of cases (206) in which the diagnosis of primary carcinoma of the lung was established by histological examination of tissue obtained on bronchoscopy (146 cases) or at necropsy (30 cases), or in which microscopic verification of the clinical and roentgenological diagnosis was based on demonstration of metastatic carcinoma in the lymph nodes of the supraclavicular, cervical, or axillary regions (27 cases). Three cases in which the diagnosis was confirmed by histological examination of a specimen from the lung obtained at operation were added.

In considering the roentgenological manifestations in these 206 proved cases of primary carcinoma of the lung, it should be kept in mind that 75 per cent of the roentgenograms were simply the routine stereoscopic, postero-anterior projections exposed at full inspiration at a target-to-film distance of 5 ft. Lateral views of the thorax were available in only 36 cases, and the report of a roentgenoscopic examination was available in only 16 cases.

The roentgenological changes which have been interpreted as atelectasis, and those classified as unilateral infiltration in the hilus (with or without extension into the parenchyma) were observed with equal frequency and represent the most significant changes in about two-thirds of the roentgenograms. Within this group (136 cases), approximately one-third presented atelectasis alone; one-third, hilar infiltration alone; and the remainder presented a combination of the two.

So-called massive atelectasis, with the classical signs of a homogeneous increase in density over an entire pulmonary field, a shift of the mediastinal structures toward the affected side, elevation of the

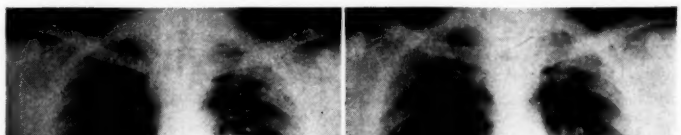


Fig. 1. ***left***, Primary carcinoma originating in left main bronchus with roentgenographic changes limited to an increased density in the left hilum. The patient, a man aged fifty, had had pain in his chest and occasional hemoptysis for eight months. Bronchoscopic examination revealed an infiltration in the wall of the left main bronchus at its junction with the bronchus to the left upper lobe. There was no ulceration; on biopsy the tissue showed only inflammatory changes. ***right***, Roentgenogram of the same patient nine months later showing increased density of the shadow in the left hilum and partial atelectasis of the left lower lobe. The patient's previous symptoms had persisted and he had lost weight. An ulcerating lesion obstructing the left lower lobe bronchus was found on bronchoscopy, and on biopsy the tumor proved to be a squamous-cell carcinoma, Grade 3.

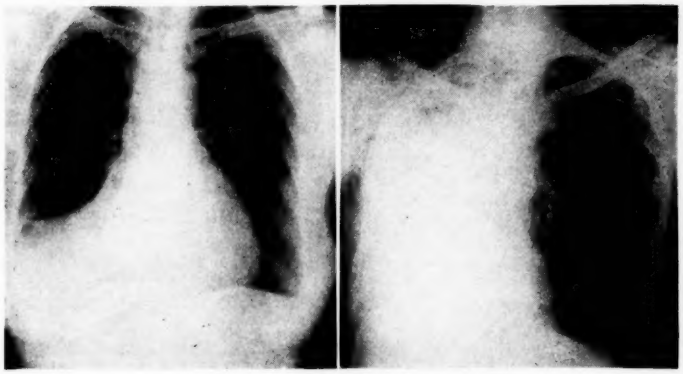


Fig. 2. *left*, Primary carcinoma of right lower-lobe bronchus showing complete atelectasis of the right lower lobe. There is moderate compensatory emphysema of the right middle and upper lobes, flattening of the diaphragm on the left, and slight deviation of the trachea to the right. The heart is not displaced. The patient was a woman, aged fifty-five, who complained of a productive cough, weakness, and loss of weight. On bronchoscopy an ulcerating bleeding lesion, which proved to be a squamous-cell carcinoma, Grade 4, was found almost completely occluding the right lower-lobe bronchus. *right*, Primary carcinoma of right main bronchus, producing massive atelectasis of the right lung. The patient, a man aged sixty-five, had suffered for two to three years with cough, dyspnea, and intermittent fever and more recently had been raising large quantities of sputum. An obstructing lesion of the right main bronchus was found on bronchoscopy, but multiple biopsies of the tumor showed only inflammatory changes. The patient died less than two months after registration at the Clinic and at necropsy was found to have a pedunculated tumor high in the right main bronchus and almost complete atelectasis of the right lung. The tumor proved to be a mucoid adenocarcinoma, Grade 2.

diaphragm, and possibly some narrowing of the intercostal spaces on the involved side, was observed in 13 cases. Although the shadow of a tumor or the reactive process in its immediate vicinity is usually obscured by collapse of a portion of the lung, that which was interpreted as being a definite tumor was recognized in association with atelectasis in 13 instances in this series. In only 5 of the roentgenograms was a well-defined tumor seen through the shadow of hilar infiltration.

In this series of 206 proved cases, evidence of fluid was observed in 33 cases, but of that group only 11 cases (about 0.5 per cent of the total) presented a picture of complete hydrothorax. Changes interpreted as bronchiectasis were noted in 15 cases and definite evidence of pulmonary abscess in 7 cases. A homogeneous dense shadow obscuring a considerable portion of the pulmonary field and characteristic of no one pathological entity was confusing in 15 cases. Lobar infiltration, more or less suggestive of pneumonia, was present in 8 cases, and bilateral mediastinal widening, not inconsistent with the changes of lymphoblastoma, was observed in 6 cases.

As incidental findings, evidence of metastasis to the opposite lung was noted in 2 cases, metastasis involving a rib in one case, and metastasis in the dorsal spine in another. Marked elevation of the diaphragm on one side, suggestive of paralysis, was observed in 9 cases, and in 1 instance the primary tumor of the lung was associated with eventration of the diaphragm on the same side.

The most nearly pathognomonic of the roentgenological changes is a unilateral increase in density in the hilus (Fig. 1), which is associated with some degree of atelectasis (Fig. 2), of scarcely less importance. One or both of these changes were observed in two-thirds of the cases studied, and in retrospect, it is clear that their presence should suggest at once the possible existence of bronchial malignancy. Likewise, the presence of an ill-defined or rounded shadow of increased density (Fig. 3), away from the region of the hilus, should be considered indicative of malignancy until proved otherwise.

Not infrequently, the earliest roentgenological changes associated with bronchogenic carcinoma are those which may readily be confused with a benign inflammatory process. In a few such instances, the demonstration of displacement phenomena in the presence of abscess or bronchiectasis, the coexistence of atelectasis and hydrothorax, or the recognition of an elevated and immobile diaphragm on one side may suggest the presence of malignancy. More often, however, the diagnosis of carcinoma will be considered only if its possibility is kept in mind.

It was found that the roentgenologist was able to make a definite diagnosis of bronchogenic carcinoma

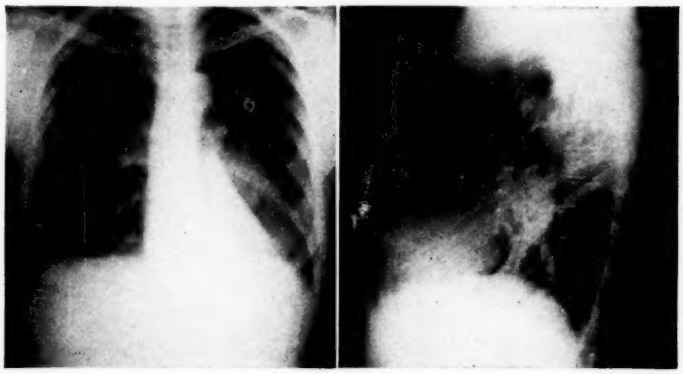


Fig. 3. *left*, Primary carcinoma of left main bronchus, producing a definite shadow of tumor in the left hilum and partial atelectasis of the left lower lobe. The patient was a woman, aged forty-six, who had complained of cough, dyspnea, and hemoptysis of only four months' duration. Bronchoscopy revealed definite stenosis of the left main bronchus just below the bifurcation of the upper-lobe bronchus and a specimen removed from the bronchial wall at that point showed adenocarcinoma, Grade 3. The patient died shortly after total left pneumonectomy. Examination of the operative specimen revealed a tumor 5 cm. in diameter involving the left hilum and lower lobe of the left lung. *right*, Lateral roentgenogram of thorax of the same patient.

or at least to suggest its presence in about 60 per cent of these 206 cases. In the remaining 40 per cent the condition in one-third was confounded with inflammatory lesions of the thorax; in one-third a merely descriptive report was made, and in the remainder the lesion was variously diagnosed as lymphoblastoma, metastatic carcinoma, interlobar fluid, tuberculosis, aneurysm, or "negative chest."

Sante, L. R.: Basal Exudates of Subphrenic Origin.
Am. J. Roentgenol., 1940, 44: 350.

This article is intended to point out the conditions which may cause conflicting opinions as to whether basal lesions of the pleural cavity have their inception in the chest, or originate in subdiaphragmatic infection, and to emphasize procedures which are of value in their differential diagnosis. Mention is made of the fact that basal shadows in the lung field most frequently have their origin within the pleural cavity, and the usual causes for them are listed. Correlation of the clinical symptoms with roentgenological findings, in most instances affords the determining factor in the differential diagnosis. In some instances such correlation may serve only to narrow the diagnosis down to a few possibilities, and extraordinary methods of examinations may be required for the ultimate differentiation. Every available maneuver should be resorted to before extraordinary procedures are instituted for diagnostic purposes. Examinations made in unusual positions may be of value, or roentgenoscopic observations of the movements of the diaphragm may aid in determining the nature of the condition. The presence of associated lesions, which the roentgen examination may disclose, frequently gives a clue as to the origin of the basal exudate.

Elevation of the dome of the diaphragm, and immobilization or restriction of excursion have been pointed out as diagnostic criteria for a subdiaphragmatic source of infection, but these are only corroborating signs which fail when there is associated pleural exudate. The injection of lipiodol into the subdiaphragmatic abscess cavity after the aspiration of pus, to determine the extent and location of the cavity, has been successful in only a few recorded cases for the determination of the subphrenic extent of the infection. If the cavity of the subphrenic abscess contains gas from bacterial action or other cause, the diagnosis may be facilitated, but even in these cases the possibility of the abscess being in the pleural cavity above the diaphragm often cannot be determined. Everything hinges on the location of the diaphragm; indeed this still remains the all important question.

In the author's experience the best procedure for answering this question is the production of an artificial pneumoperitoneum which will aid in the exploration of a subphrenic space by roentgenological examination. He has used it many times without unusual consequences. Only a small amount of air is needed, and this may be injected with a very simple pneumoperitoneum apparatus, consisting of a Potain aspirator pump, lumbar puncture needle, and suitable tubing and connectors. Examinations in suitable positions after the air injection can readily reveal whether the subdiaphragmatic space is clear or obliterated by inflammatory processes or adhesions.

Among the conditions encountered leading to subdiaphragmatic abscess in which pneumoperitoneum has been used and proved valuable, the following are mentioned and illustrated by roentgenograms: (1) perforating lesions of the stomach and duodenum, (2) purulent appendix, and (3) splenectomy. Instances in which subphrenic purulent collections were demonstrated to have ruptured into the chest cavity and into a bronchus are also included. In the author's experience, no other method will determine so clearly the subphrenic origin of thoracic lesions as pneumoperitoneum.

ADOLPH HARTUNG, M.D.

Vallebona, A., and Dogliotti, V.: Roentgen and Tomographic Exploration of the Female Genitalia with a Small Pneumoperitoneum and Pneumocystography (L'esplorazione radiologica e stratigrafica dell'apparato genitale femminile col piccolo pneumoperitoneo e con la pneumocistografia). *Folia demograph. gynaec.*, 1940, 37: 240.

In 1937, the authors described a technique which gave interesting results in the roentgen examination of the female genital system. This technique was based on the use of a small pneumoperitoneum (at most from 350 to 400 c.cm.) and of simultaneous pneumocystography with the patient in the prone position and the head lower than the feet so that the body was at an angle of from 20 to 25 degrees to the horizontal. The roentgen exposure that gave the best results was the axial caudocranial one of the pelvis; an excellent view was obtained of the uterus, the parametrium, and the ovaries, as demonstrated in a series of normal and pathological cases.

At the time, the authors pointed out that the new technique was not intended to replace hysterosalpingography, which constitutes an investigation of a totally different nature, but that it should be used to supplement the latter in order to give a more complete morphological picture of the internal genital organs. Unfortunately, even with the new technique, the superimposition of various images in the film gives a very complex picture in which it may be difficult to recognize the various anatomical elements. Therefore, the authors have taken advantage of recent advances in roentgenography and have combined their method with tomography, which allows selecting for study any layer of the pelvis and, consequently, any of its elements individually. They discuss briefly the properties of the apparatus which they use and point out that it allows exposures of one-tenth of a second, does not impose any limitations on the focus film distance (with absence of deformation and maximal structural detail in the pictures), leaves the tube immobile, and employs the anti-diffusing diaphragm.

The patient is prepared with a cleansing enema, and the necessary amount of filtered air is introduced into the peritoneal cavity by means of the ordinary pneumothorax apparatus. The patient is placed in the recommended position and 2 roentgenograms are made, 1 sagittal, perpendicular to the plane of the film, and 1 axial caudocranial of the pelvis; 200 c.cm. of filtered air are introduced into the bladder by means of an ordinary syringe and the two exposures are repeated. Then a series of tomograms is taken, the thickness of the layer corresponding to a rotation angle of 20 degrees, the time of exposure being one second, and the focal distance 1.50 meters.

Various cases of fibromyoma, ovarian cyst, uterine hypoplasia, and hematocolpos are demonstrated with roentgenograms, tomograms, and surgical verification. On the basis of these cases, the authors show that, if the simple graphic representation of these morbid forms presented the initial advantage of replacing the tactile by the visual sense and of demonstrating the evolution of the disorder, the additional use of tomography, which allows differentiation of the shadows originating in a certain layer, affords even greater diagnostic exactness. However, it should not be forgotten that in the usual cases simple clinical examination may be more than sufficient to establish a correct diagnosis.

RICHARD KEMEL, M.D.

Hubeny, M. J., and Mass, M.: Roentgenological Aspects of Metastases. *Radiology*, 1940, 35: 315.

Much of the roentgenological evidence from which conclusions might be drawn regarding the incidence and behavior of metastases is lacking in thoroughness. Careful correlation of the autopsy examination and the roentgenographic findings is unfortunately lacking in many of the published reports.

The pathologist has long been disillusioned as to the predictability of behavior of metastatic processes and the authors believe that the radiologist remains too credulous of generalities which have long been made.

The records of Cook County Hospital covering 1,365 cases seen at necropsy have been reviewed. Positive roentgenographic findings occurred in approximately 74 per cent of the cases showing skeletal or bony metastases. Of the cases studied, 167 showed skeletal metastases, an incidence of 12 per cent.

The incidence of skeletal metastasis found by the authors was as follows: 7 of 83 cases of carcinoma of the esophagus; 7 of 23 cases of lymphosarcoma; 5 of 74 cases of myelogenous leucemia; 2 of 20 cases of lymphatic leucemia; 5 of 39 cases of Hodgkin's disease; 3 of 26 cases of carcinoma of the liver; 3 of 69 cases of carcinoma of the pancreas; 2 of 16 cases of osteogenic sarcoma; 4 of 16 cases of carcinoma of the testes; 7 of 25 cases of epidermoid carcinoma of the oral cavity, naso-pharynx, and skin; 4 of 23 cases of carcinoma of the urinary bladder; 36 of 150 cases of bronchogenic carcinoma; 6 of 14 cases of carcinoma of the thyroid; and 5 of 26 cases of carcinoma of the adrenal gland. Single cases of bone metastasis from carcinoma of the stomach, extrahepatic bile ducts, ovary, and sigmoid colon were included in this series. There were also 2 cases of skeletal metastases from carcinoma of the cervix.

In the entire series 359 cases presented metastases to the lung or pleura, or both. A detailed analysis of the pulmonary series is unnecessary because the pathologist finds the maximum possible incidence. In carcinoma of the prostate, approximately 27 per cent of the roentgenographically visible lesions are found within the thorax without skeletal metastases.

HAROLD C. OCHSNER, M.D.

Hunt, H. B.: The Treatment of Large Protruding Carcinomas of the Skin and Lip by Irradiation and Surgery. *Am. J. Roentgenol.*, 1940, 44: 254.

The large, protruding, bulky carcinoma of the skin or lip presents a discouraging and formidable appearance, but experience shows that this type of tumor responds well to adequate treatment by irradiation or surgery. Statistical studies justify a better prognosis for the bulky protruding tumor than for the ulcerating invading lesion.

Bulky squamous-cell carcinomas tend to be moderately to highly anaplastic and show an abundant delicate vascular network which is associated with moderately high radiosensitivity. The prognosis is reassuringly good since metastases to regional lymph nodes are remarkably infrequent, in view of the size and activity of the primary lesion. Deformity following eradication of the neoplasm by irradiation is surprisingly little because of only superficial invasion of healthy tissues by the neoplasm. The tumors can be successfully treated by roentgen rays, radium, surgery, or a combination of these agents, according to the individual problem or in keeping with the equipment and experience of the therapist. In general the author favors:

1. Surgical resection and plastic repair for Grade I carcinoma and radioresistant papillary tumors in general, and large tumors overlying the brain.

2. Irradiation of the base after removal of the protuberant portion of pendulous or polypoid carcinoma.

3. Preliminary roentgen-ray treatment followed by interstitial irradiation in the remnants of the base of the usual sessile tumor, if and as indicated.

The defect after surgical resection can be closed by a skin graft, sliding flaps, or other reparative procedures. Repair by the thick split-graft speeds healing and gives a good cosmetic result. Surgical resection of a large papillary tumor of the lip by the average surgeon causes much more disfigurement and disturbance of function than irradiation. On the other hand, the deforming, invasive, ulcerating carcinoma of the lip is better treated by surgery than by irradiation in case it is still resectable. The benign or low grade of papillary tumor is better treated by surgery than by irradiation because of the radioresistance of the lesion. JOSEPH K. NARAT, M.D.

Wigby, P. E., and Cohen, M.: Radiation Therapy of Carcinoma of the Skin; An Analysis of 83 Lesions in 70 Patients. *Radiology*, 1940, 35: 70.

After a brief review of the technique of radiation therapy of cutaneous carcinoma, as found in 11 articles collected at random from the literature, the authors analyze the procedure used in their own series of 83 lesions which occurred in 70 patients. They arrive at the following general conclusions:

1. Basal-cell carcinoma is best treated by low voltage roentgen therapy with a dose ranging from 4,000 to 5,000 roentgens, at from 90 to 130 kv., and with no filter or a filter of 1 mm. of aluminum. The entire dose is delivered within two weeks, most cases requiring less than seven days. For lesions 3 cm. in diameter from 600 to 1,000 roentgens are given daily, whereas for lesions more than 3 cm. in diameter the daily dose varies from 200 to 400 roentgens, the smaller dose being used for the larger lesions.

2. Intradermal, adenocystic, and infiltrating basal-cell and squamous-cell lesions receive a dose from 5,500 to 6,500 roentgens of medium or deep roentgen therapy, at 145 kv., and with a filter of 0.5 mm. of aluminum, and at 200 kv., with a filter of 2 mm. of copper plus 1 mm. of aluminum. In small lesions 1,000 roentgens are given the first day and 600 roentgens daily thereafter; in larger lesions the irradiation is carried out with 200 roentgens daily.

3. A great variation in the dosage, depending on the thickness and surface area of the lesion, is to be avoided. The use of radium is not recommended because of the great length of time required for such treatment. TRAIAN LEUCUTIA, M.D.

Jacobsen, V. C.: The Deleterious Effects of Deep Roentgen Irradiation on Lung Structure and Function. *Am. J. Roentgenol.*, 1940, 44: 235.

This article is concerned chiefly with the reasons usually invoked for the pursuance of a program of deep roentgen treatment of a suspected tumor of the lung. It also reviews the deleterious effect of roentgen rays when directed upon the lungs.

In the main, the article is devoted to reporting in detail the case of a man, diagnosed clinically as having a cancer of the lung, subjected to deep roentgen therapy over a period of nine years, and whose death was undoubtedly the result of the roentgen therapy and not directly of the neoplasm. A complete clinical and post-mortem study is included, and an attempt is made to correlate the symptoms with the pathology found at autopsy.

The value of roentgen therapy in the treatment of cancer of the lung is emphasized, but the pleural and pulmonary damage which may follow such measures should be kept in mind and guarded against as much as possible. An increase in such complications is prophesied unless improvements in radiation technique are forthcoming. The survival time following the demonstration of bronchial carcinoma either by means of the roentgen rays or biopsy is usually short, but this case demonstrated that roentgen therapy may prolong life very materially, provided metastasis has not occurred. The sixteen-year interval between the original diagnosis and death is possibly the longest yet recorded for this type of neoplasm treated by non-surgical methods.

ADOLPH HARTUNG, M.D.

Taylor, A. G. C.: Supplementary X-Ray Treatment for Carcinoma of the Cervix Uteri in Relation to the Direction of the Spread of the Disease. *Brit. J. Radiol.*, 1940, 13: 293.

Although there is little scope for improvement in the results of the treatment of carcinoma of the cervix uteri by radium treatment alone because of the geometric limitation inherent in this form of treatment, the author believes there is considerable promise of improvement by combining roentgen therapy with it. He contends that this is true especially if adequate doses be delivered to sterilize the disease, and that this can be done if the involved area only be irradiated. Usually such involvement is unilateral and includes localized groups of glands on the pelvic wall in close relation to the lateral attachments of the broad ligaments. Radium dosages, only, delivered to the various structures by techniques in common use are shown to be inadequate to eradicate the disease if it has extended to the lateral part of the parametrium or to the adjacent pelvic glands.

Extensive consideration is given to the lymphatics of the cervix, to the pathology of the disease as regards its spread, and to the structures found involved in it at operation and autopsy to explain the rationale of the technique he has developed. This technique is described in detail. Clinical observations made when it was used are recorded, and illustrative cases are cited at length.

A careful study of the cases treated has convinced the author that it is nearly always possible to determine within a few days of the completion of radium treatment which direction is the main direction of spread, or whether the spread is symmetrical, and then to direct the supplemental roentgen treatment accordingly. He believes the radium treatment may be relied upon to deal with the local lesion and the less affected side, whereas the spread to the more affected side should be intensively cared for by additional x-ray therapy.

In the author's opinion irradiation with roentgen rays should, as a general rule, be subordinated to that with radium and should follow the latter. The following scheme of treatment, based on these principles and on the belief in the necessity of irradiating the smallest possible block of tissue, is practiced by the author, and is submitted in this thesis.

1. Preliminary x-ray treatment or x-ray treatment only
   a. Very septic cases
   b. Cases in which the arrangement of radium foci would be quite unsatisfactory
      (1) Cases with very contracted vaginal vaults
      (2) Cases of very large proliferative tumors
      (3) Cases with both fornices markedly thickened with tumor tissue
   c. Cases with vaginal involvement below the upper third
   d. Some Stage IV cases
2. Radium treatment only
   a. Stage I or Stage II cases in which the radium treatment is correct and the tumor symmetrical
   b. Advanced Stage III cases
   c. Some Stage IV cases
3. Radium and x-ray treatment of the cervix and middle half of the pelvis
   a. Stage I and Stage II cases which are symmetrical but in which radium treatment has not been satisfactory
4. Radium and x-ray treatment to the whole pelvis
   a. Stage III cases (bilateral) in which the general condition is good
5. Radium and unilateral x-ray treatment to the more affected side
   a. Stages I, II, and III in which radium treatment is satisfactory and in which it seems probable that the other side will be controlled by the radium treatment
6. Radium and unilateral x-ray treatment extended to cover the uterus
   a. As in Group 5, except that the arrangement of the radium is not satisfactory

ADOLPH HARTUNG, M.D.

Chydenius, J. J.: The Healing Process in Uterine Carcinoma Following Irradiation according to the Stockholm Method (Der Heilungsprozess bei Strahlenbehandlung des Gebaermutterkrebses nach der Stockholmer Methode). *Acta obst. et gynec. Scand.*, 1940, 20: 157.

The material studied by the author consisted of operative specimens of cervical carcinoma from patients who had received radium treatment pre-operatively, and from biopsy and autopsy material taken from similar types of patients. This material enabled the author to observe, in series, the effects of radium treatment in carcinoma of the uterus, from the first stages of treatment up to a period of three years after treatment had been instituted. The Stockholm method of radium treatment for cancer of the cervix consists of the following three fractions: one week intervenes between the first and second treatment, and three weeks between the second and third treatment. The filter used was constantly equivalent to 3 mm. of lead. The type of applicator varied; whenever possible a tube, extending from the os to the fundus, was inserted into the uterus. When necessary, appropriate vaginal applicators were used simultaneously, being held in place by a tampon.

At the author's request, isodosage curves for the different radium implants used were worked out mathematically by P. E. Tahvonen. In working out these isodosage curves the absorption by the filters was taken into consideration but the tissue absorption was not considered. These isodosage curves were drawn upon celluloid paper in natural size and were used in the clinical studies. By adding the amounts of the various isodosage curves, the approximate intensity of the irradiation on any selected point in the tumor can be determined.

The author's histological studies were performed in the following manner:

1. Several biopsy specimens were obtained in every case before irradiation was begun.

2. From 8 to 10 sections were removed from each operative specimen.

3. A large variety of fixing fluids were used (formaline, Zenker solution, "Susa" solution, Mueller formaline, Mueller-formaline-Schridde, and Cajal solution). The specimens were stained with hematoxylin, von Giesen, or with hematoxylin and eosin.

The end-results obtained are illustrated by a series of photomicrographs showing the typical changes observed in the various types of cases. The effects of the three different fractions of the Stockholm method were examined separately as well as together. The maximum dosage was computed in roentgen units, both for the local radium treatment as well as for the supplementary treatment with x-rays. The isodosage curves are depicted in the text. On the basis of his studies, the author feels justified in assuming that the manner in which the cells are acted upon by the intermittently absorbed radium energy largely determines the degree and nature of the degenerative changes which these cells undergo (so-called "Treffertheorie"). From the histological studies of the author, it appears that the mesenchymal reaction begins at a very early stage, and that in addition to various types of wandering cells, the local connective tissue plays a very important part.

The author realizes that histological studies alone cannot form the basis for determining dosage. The tolerance of the normal tissue sets the upper limits of the irradiation dosage. In the treatment of cervical carcinoma, one must be particularly careful because of the possibility of injuring the rectum. Special difficulties are created if the primary tumor is very large and there is marked parametrial infiltration. Attention is called to the advantages offered by the Stockholm method of irradiation.

HARRY A. SALZMANN, M.D.

Colby, F. H., and Dresser, R.: Advances in the Roentgen-Ray Treatment of Tumors of the Bladder. *New England J. Med.*, 1940, 223: 565.

Within the last few years the authors have been subjecting some of their patients with deep-seated malignancies, including tumors of the bladder, to supervoltage roentgen-ray therapy at from 1,000 to 1,200 kv. constant potential. The factors they are using are mentioned. The advantages of this type of radiation are fourfold. Because of the high intensity it becomes feasible to use a long target-to-skin distance, which increases the depth dose.

Approximately 50 per cent of the radiation delivered at the surface reaches the center of the average-sized pelvis. There is a greater tolerance of the skin as compared with the usual 200-kv. rays. The amount of radiation reaching deeply is very little affected by the size of the portal of entry. It is therefore possible to use smaller fields covering only the disease-bearing area without having to resort to large portals to increase the depth dose. With small portals of entry, the amount of scattered radiation is about one-third of that produced with 200 kv. This results in a lessened general reaction (roentgen sickness) on the part of the patient.

The technique employed by the authors in connection with carcinoma of the bladder is described in detail. They have been impressed with the dearth of untoward reactions in normal structures, and it seems likely that doses much greater than have thus far been employed will eventually be considered justifiable.

Thirty-five patients with tumors of the bladder have been treated during the last three years, and the results have been carefully checked. The authors believe the radiation differs sufficiently from other methods to require a separate evaluation. The results thus far seem to warrant its continuation. Even though sufficient time has not elapsed to consider cure, regression of the tumor and alleviations of symptoms may be evaluated.

Supervoltage radiation has been used only to treat patients with extensive malignant tumors, unsuited to surgery, or those too feeble to stand operation. The types of tumors treated are classified and the individual dosages given are tabulated. The response of the different types of neoplasms are summarized and described at some length. As a result of treatment, more than one-half of these tumors regressed.

Gross disappearance, determined by cystoscopic examination, occurred in about one-third of the cases. Frequently, however, the disappearance was only temporary and recurrence was obvious in a few weeks or months. The effects of radiation seemed more marked on the intravesical portions of these tumors than on the parts that had deeply invaded the bladder wall. In many cases induration of the bladder wall persisted and was readily detected by rectal or vaginal examination.

Bleeding or frequent and painful urination was relieved in more than half the cases. Such relief was frequently only temporary, and symptoms returned with extension or reappearance of the growth. In an occasional patient the condition was made worse by treatment.

In conclusion, the authors state that the results obtained with this supervoltage method of treatment are definitely superior to those observed by them in treating similar tumors with rays produced at lower voltages. ADOLPH HARTUNG, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Busse Grawitz, P.: The Demonstration of Life in Tissues of American and Egyptian Mummies (Pruebas de vida en los tejidos de momias americanas y egipcias). *Semana med.*, 1940, 47: 287.

Three methods of tissue culture are described by the author: the first employs citrated plasma, the second semi-permeable collodion membranes, and the third subcutaneous implantations.

Observations on tissue cultures of tendons from an embryo preserved thirty-eight years in alcohol, from a body of an Indian of a relatively remote epoch, and from Egyptian mummies established two facts: (1) human tissues are able to produce reactions and form cells 5,300 years after the death of the individual, and (2) a homogeneous mass is able to create cells.

The author succeeded in producing a formation of leucocytic cells in citrated plasma which served as a culture medium for tissues from Egyptian mummies. These tissues had completely lost their differentiation, and had no nuclei, cells, or recognizable blood vessels. The transformation of such a homogeneous mass into a proliferating, active conglomeration of cells is one of the marvels of nature. The question arises: What is the nature of the forces within our tissues responsible for a differentiation of the molecules into nuclei and cells, and their subsequent divisions? Poisons, light rays, time, or a combination of all these factors is unable to destroy such forces; they can be eliminated only by high temperatures. The whole problem belongs to the mysteries of life.

The aforementioned reactions of tissues from mummies refute Virchow's conception of cellular pathology and point to the molecular concept of pathology.

The author's observations explain how a cancer, in spite of anatomical disintegration of its cells under the influence of x-rays or radium, is able after a number of years to form a recurrence.

JOSEPH K. NARAT, M.D.

Sorce, G. Experimental Research on Fat Embolism (Ricerche sperimentali sull' embolia grassosa). *Sperimentale*, 1940, 94: 164.

For his experiments, Sorce used large rabbits and dogs and injected intravenously fat extracted from the subcutaneous fatty tissue or from the bone marrow of human subjects. He found that the injections were followed by acute dilatation of the heart which sometimes assumed a grave aspect and was caused by: (1) a serious disturbance of the nutrition of the cardiac muscle by the presence of emboli which obstructed many of the preterminal arteries and capillaries; and (2) an immediate, progressive, and enormous demand following the introduction into the circulation of a fluid which has different physicochemical and physical characteristics from those of the blood and which is nearly entirely localized in the small circulation a few minutes after the injection. The dilatation of the heart may be rapidly fatal but, if it is overcome, it regresses and disappears in from one to twenty-four hours because of the extremely profuse vascularization of the cardiac muscle which facilitates the elimination of the emboli.

The disturbances due to changes in the nutrition of the heart (angina pectoris) are noted for their rapidity of occurrence and their immediate gravity; the author thinks that they offer great similarity to the cardiac disturbances presented by the animals during his experiments, namely, cardiac crises due to changes in nutrition with the addition of a serious mechanical obstacle.

In 2 rabbits the author observed degenerative changes in the kidneys and, because no such changes were found in the other experimental animals, he is inclined to attribute them to the presence of a site of minor resistance brought to light by the introduction of fat into the venous circulation, rather than to embolism. The fact that degenerative changes may occur in the kidneys in fat embolism has also been observed by other authors.

The notable increase in the sedimentation rate of the red cells, observed by the author, is referred to the modifications which the fat embolism causes in the blood plasma by changing its physicochemical constants; logically, this should be an increase in the plasma proteins. This conclusion is supported by the results of the determination of the refractometric index, which increased rapidly to reach its maximum in from five to ten days, remained stationary for a few days, and then decreased slowly to return to normal within one month. It is known that the refractometric index increases with the increase of the protein content of the serum and that the substances with large molecules, the globulins, give the greatest refraction. Consequently, the results show that fat embolism is accompanied by marked physicochemical changes in the plasma which consist of an increase in the proteins, which are more dispersed and have a larger molecule: the globulins (fibrinogen, euglobulin, and pseudoglobulin).

The scarcity of nervous symptoms compared to the gravity of the cardiopulmonary symptoms imposes the conclusion that the usual cause of death in fat embolism lies in a grave cardiac crisis which finds its anatomico-pathological expression in the acute dilatation of the heart, the presence of which is demonstrated by roentgen examination before death. This cardiac crisis is determined first of all by a serious and immediate disturbance in the nutrition of the myocardium, as shown by histological examination of animals which died or were killed a few

minutes after the experiment was started, and, second, by a serious and progressive mechanical obstacle, as demonstrated by the injection of opaque fat into the circulation. The demand for a marked functional activity in a heart which presents disturbances of nutrition seems to be the principal cause of the crisis, and of death if the possibilities of compensation in the myocardium are insufficient. The renal and the physicochemical changes found, similar to the changes in other disorders, prove that if the initial crisis is overcome, fat embolism causes complex general disturbances of such a nature as to justify speaking of a morbid reaction which finds its clinical expression in the disturbances presented by the animals during the days following the experiment. RICHARD KEMEL, M.D.

SURGICAL PATHOLOGY AND DIAGNOSIS

Castex, M. R., López García, A., and Zelasco, J. F.: A Method of Determining the Amount of Bilirubin in the Blood; Total, Direct, and Indirect. The Reaction of Ehrlich-Proescher and the Photometer of Pulfrich (Sobre un método de dosaje de la bilirrubina en la sangre: total, directa e indirecta. R. de Ehrlich-Proescher—Fotómetro de Pulfrich). *Rev. Soc. argent. de biol.*, 1940, 16: 257.

The authors trace the successive improvements made in determining the amount of bilirubin in the blood since Van den Bergh first published his technique. Until lately the best method was that of Varela Fuentes and Recarte who made use of the capacity of chloroform when associated with a certain amount of sodium sulfate, to extract nearly completely the indirect bilirubin from the blood serum; the direct bilirubin was then determined in the serum remaining after treatment. The fact that some indirect bilirubin was always left in the serum made it appear that all serums contain direct bilirubin, which is contrary to all actual concepts of physiopathology. During 1939, Castex, López García, and Zelasco conducted a series of investigations which enabled them to develop a technique which, in their opinion, solves completely the problem of determining the total as well as the direct and indirect bilirubin.

The new technique is summarized as follows:

Tube No. 1—total reaction. 1 c.cm. of serum, 3 c.cm. of distilled water, 1 c.cm. of caffein-sodium benzoate at 50 per cent, and 2 c.cm. of diazo reagent.

Tube No. 2—direct reaction. 1 c.cm. of serum, 4 c.cm. of distilled water, 2 c.cm. of diazo reagent; heat for fifteen minutes at 60° C.

Tube No. 3—contrast. 1 c.cm. of serum, 5 c.cm. of distilled water, and 1 c.cm. of caffein-sodium benzoate.

The caffein-sodium benzoate may be prepared by mixing 20 gm. of pure caffein, 30 gm. of pure sodium benzoate, and 70 c.cm. of distilled water (to be heated and filtered).

Reading is done in the photometer of Pulfrich with a layer of appropriate thickness and filters S55 and S53 to obtain a thickness of 1 cm. The A values are 91 for S53 and 101 for S55. The values obtained with the filter, which gives the highest amount in milligrams, are accepted as the most correct ones. In most cases, the values are the same, but they may be lower for S53 when the turbidity has not been exactly compensated.

When the values are low or normal, it is advisable to replace the distilled water in the three tubes with a solution of saccharose concentrated to the point of becoming syrupy. The increase in homogeneity of the medium makes it more transparent and may even allow its adaptation to colorimetric readings; this point is now being studied. Three cubic centimeters must be put in each tube, and 1 and 2 c.cm. of water must be added to Tubes 2 and 3, respectively, to make the amount of saccharose the same in each tube. The authors recommend the systematic use of the addition of saccharose because its advantages are evident.

In cases of uremia or of severe urobilinuria, the readings with S55 are more correct than those with S53 because in this zone of the spectrum there is less absorption of the products of reaction with the diazo reagent (urobilinogen, bilirubinoids and conjugation products of phenol and benzol). In these cases it is safer to use the method of Heilmeyer and Krebs. The authors are now studying the solution of this problem, which is connected with the yellow reaction of Varela Fuentes. RICHARD KEMEL, M.D.